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Lenz Oil Participating Respondents

Technical Memorandum No. 4
Light Nonaqueous Phase Liquid
Evaluation

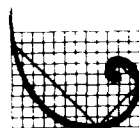
Lenz Oil Site
Lemont, Illinois

March 22, 1995

REVISION NO. 1

Project No. 94017-07

Environmental Resources Management-North Central, Inc.
540 Lake Cook Road, Suite 300
Deerfield, Illinois 60015



ERM.

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1.0

INTRODUCTION

This Technical Memorandum No. 4 presents the results of Environmental Resources Management-North Central, Inc.'s (ERM-North Central's) light nonaqueous phase liquid (LNAPL) investigation at the Lenz Oil Service, Inc. (Lenz Oil) site. ERM-North Central was retained by the Lenz Oil Participating Respondents to prepare the "Field Sampling Plan Addendum A: Light Nonaqueous Phase Liquid Evaluation" (the FSP), and conduct the LNAPL investigation at the site. All of the field activities were conducted in accordance with the FSP, which was approved by the U.S. Environmental Protection Agency (USEPA) on July 6, 1994.

1.1

OBJECTIVES AND SUMMARY OF THE INVESTIGATIVE ACTIVITIES

As indicated in the FSP, this investigation was conducted to characterize the LNAPL at the site. The investigative activities included the:

- Installation of piezometers,
- Collection and analysis of LNAPL samples,
- Collection and analysis of soil samples,
- Surveying of the piezometer locations and elevations,
- Measurement of the depth to the water and LNAPL in all of the piezometers and shallow monitoring wells at the site, and
- Bail-down testing of various piezometers and monitoring wells.

1.2

ORGANIZATION

All of the site investigation activities pertaining to the LNAPL investigation were performed by ERM-North Central personnel and its subcontractors, including Rock and Soil Drilling Corporation of St. Charles, Illinois; Advanced Surveying and Mapping, Inc. of Batavia, Illinois; and Quanterra, Inc. (Quanterra) of Santa Ana, California. ~~Black & Veatch Waste Science, Inc. (B&V) of Chicago, Illinois, An Alternative Remedial Contracting Strategy (ARCS) contractor~~ under contract to the United States Environmental Protection Agency (USEPA), was assigned by USEPA to oversee the field activities.

Field activities were performed between **August 1, 1994 and November 8, 1994**. A chronology of the investigation activities is presented in **Table 1-1**, and the rationale for these activities is discussed in this subsection.

According to Section 1.0 of the FSP, a total of 22 locations were identified for possible installation of piezometers during this investigation. Piezometers were to be installed based on results of field observations as detailed in the FSP. If the extent of the LNAPL could not be defined by the data obtained from the 22 proposed locations, additional locations would be evaluated as necessary. As shown on Table 1-1, the criteria for installation of piezometers were satisfied at 13 locations, where piezometers were installed during the initial phase of LNAPL investigation in August of 1994. Subsequently, six additional piezometers were installed during September and October 1994 to complete the delineation of the LNAPL. The locations of all of the piezometers and monitoring wells that are currently located at the site are shown in Figure 1-1.

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Beginning on August 19, 1994, ERM-North Central collected measurements of the depths to the LNAPL (if any) and the water in the newly installed piezometers and the existing shallow wells at the site. Based on the presence of LNAPL in the three downgradient piezometers (i.e., P19, P20, and P21) from the initial phase, four additional piezometers (P23 through P26) were installed on September 12 and 13, 1994 to delineate the extent of the LNAPL. Three of the four piezometers (i.e., P24, P25, and P26) were installed to delineate the southeastern extent of the LNAPL in the downgradient ground water flow direction, and the fourth piezometer (i.e., P23) was installed to delineate the southwestern extent of the LNAPL in the vicinity of monitoring well G106S.

Two additional piezometers (i.e., P24S and G102S) were installed on October 14, 1994 to confirm the absence of LNAPL at these locations. Piezometer P24S was necessary because of the poor recovery of soil samples from piezometer P24, confined conditions present in the aquifer (see Section 3.0), and apparent traces of LNAPL in the ground water during the development of this piezometer. The top of the screen of the shallow monitoring well G102L, which was installed prior to the Remedial Investigation (RI) sampling activities, was originally located beneath the top of the water table. To confirm the absence of measurable LNAPL at either of these locations, two shallow piezometers (i.e., P24S and G102S) were installed with the top of the screen above the water table.

Soil samples were collected from five of the piezometer locations (i.e., at P01, P06, P08, P13, and P24S) for the following reasons:

- P01 and P13 - Soil samples were required at these locations as specified in the FSP.
- P06 and P08 - Samples were collected because stained soils indicative of the presence of LNAPL were encountered in the soil borings.
- P24S - A sample was collected because the odor emanating from the soil during the installation of P24 was different from that observed throughout the rest of the site.

Measurable amounts of LNAPL were observed in the piezometers at two of the five soil sampling locations (i.e., at P01 and P13). In accordance with the FSP, soil samples were not collected from the rest of the piezometers for the following reasons:

- P02 through P05, P07, P09 through P12, and P22 - No samples were required from these locations.
- P14 - No sample was obtained from this location because the sample interval above the water table was comprised of silty sandy gravel and no soil recovery was obtained from this interval in three successive attempts.
- ~~P14~~ P15 through P17 - No samples were required if bedrock was encountered prior to reaching the water table.
- P18 through P21 - No samples were required because: (1) no staining or **field screening** indicated the presence of LNAPL, and (2) the bedrock was encountered prior to reaching the water table.

Modifications of and additions to the approved FSP methodologies were made because of conditions encountered during the completion of the field work. This section presents all of the FSP revisions, which were approved by the USEPA prior to their implementation.

2.1

PIEZOMETER INSTALLATION

As previously indicated, a total of 19 piezometers were installed at the site between August 1, 1994 and October 14, 1994 (see Table 1-1).

Construction details for the piezometers and shallow monitoring wells are provided in Table 2-1. Soil boring and monitoring well construction logs for the piezometers are included in Appendices A and B, respectively, and the reported site survey results are included in Appendix C.

The drilling procedures were slightly modified from the approved procedures for some of the piezometers as follows:

- Soil was continuously sampled ahead of the hollow-stem augers by using a 3-inch-diameter split-spoon sampler (24-inch length) driven by a 300-pound slide hammer to overcome the resistance provided by the large cobbles and miscellaneous fill materials found during drilling.
- Twelve (12) piezometers (i.e., P13, P14, P15, P19, P20, P21, P23, P24, P24S, P25, P26, and G102S) were drilled without split-spoon or core sampling from the top of bedrock to their total depth by using either hollow-stem augers or a rotary bit. The soil was not continuously sampled because previous drilling had indicated that the water table was below the top of bedrock, and, in accordance with the FSP, the collection of soil samples was unnecessary in this case. Additionally, the bedrock was not cored because any coring would have resulted in a significant loss of water to the limestone bedrock and potentially prevented the accumulation of LNAPL in the piezometer. With the USEPA's consent, drilling progress was monitored by examination of the cuttings, since sufficient stratigraphic information about the bedrock was already available from cores collected during the Remedial Investigation (RI). The screen elevation data for all of the piezometers and relevant existing monitoring wells are presented in Table 2-1.
- At locations where a rotary bit was used to drill into bedrock (i.e., P13, P14, P15, and P16), the volume of fluid lost to the formation

during drilling was pumped out of the boring with a down-hole pump prior to the installation of a piezometer.

- At three locations (i.e., P15, P20, and P23) the riser pipe was extended to approximately 0.5 feet below ground surface (BGS) and a flush-mounted casing protector was cemented into place around the riser pipe to prevent any damage to the piezometers from traffic (i.e., P15 and P23) and to meet the land owner's request (i.e., P20).
- At two locations (i.e., P24 and P24S), concrete forms were used to extend flush-mounted casing protectors to an elevation of approximately 1.5 feet above the ground surface. This was necessary because the future owner of this property intends to place approximately 1.5 feet of fill in this area.

The locations and elevations of the piezometers installed during the LNAPL investigation were surveyed by Advanced Surveying and Mapping, Inc., by using coordinates based on the system initially established during the RI. The survey results are included as Appendix C. While minor discrepancies (<0.6 feet) were noted at the corners of the site, the coordinates of the existing wells were field checked and were within 0.1 feet of the original survey. Thus, the accuracy of both surveys are sufficient for this investigation as prescribed by the "Remedial Investigation/Feasibility Study Sampling and Analysis Plan" (SAP), dated November 12, 1990.

2.2 *PIEZOMETER DEVELOPMENT*

Each piezometer installed during the LNAPL field investigation was developed prior to the measurement of water levels at the site. The well development procedures specified in the SAP, as modified in the "Remedial Investigation Report," dated October 16, 1992 (the RI Report), were used to develop all of the newly installed piezometers. Copies of well development summary forms that show the amount of water removed from each piezometer and the field measurements collected during well development are included in Appendix D.

2.3 *DEPTH TO LIGHT NONAQUEOUS PHASE LIQUID AND WATER MEASUREMENTS*

The depths to the LNAPL and water in each piezometer and shallow monitoring well at the site were measured with a Keck Instruments, Inc. (Keck) KIR-89 interface probe during the first two rounds of depth measurements as described in the FSP.

The interface probe was decontaminated prior to and after being used at each piezometer or monitoring well as specified in the SAP. This procedure consisted of washing the interface probe with an Alconox and water mixture and then rinsing it with distilled water. Because all visible traces of LNAPL could not be removed from the probe by using this procedure, a hexane rinse step was added after the first round of depth measurements.

However, because the interface probe was difficult to decontaminate after contacting the LNAPL, a Slope Instruments electronic indicator was used to measure water levels in wells with no apparent LNAPL (i.e., based on observations during the drilling, development, or previous depth-to-water measurement activities) to minimize the possibility of cross contamination. The electronic water level indicator was thus used after the first two rounds of water and LNAPL measurements to ensure an added margin of safety. The procedure to measure the depth to water with the electronic water level indicator is as follows:

- The indicator was decontaminated prior to and after being used at each piezometer and monitoring well according to the procedures described in the SAP.
- The depth to water was measured as specified in the SAP.
- After the indicator was withdrawn, the **tip of the probe was carefully checked for the presence of LNAPL.**
- If any indication of oily residue was observed on the electronic indicator's probe, ERM-North Central again used the interface probe to determine the depth of any measurable LNAPL as specified in the FSP.
- If a measurable amount of LNAPL was found, the interface probe was subsequently used each time the depth-to-water was measured in that specific piezometer or monitoring well.

2.4

BAIL-DOWN TESTING

As specified in the FSP, bail-down tests were performed during the LNAPL investigation to determine the **true thickness** of LNAPL at the water table. The test results are summarized in **Section 4.2** and the data collected and graphical analyses are included in Appendix E.

Bail-down tests were performed on monitoring wells MW-5S and G106SL on August 26, 1994 and piezometers P01, P19, P20, and P21 on October 13,

1994. The tests were completed as indicated in the approved FSP with the following exceptions:

- Piezometers P01, P19, P20, and P21 were purged of LNAPL by using a peristaltic pump. Because the bail-down testing was performed immediately after the collection of samples, this method of purging was used to more quickly remove the LNAPL and extract smaller amounts of the underlying ground water. The use of a peristaltic pump, which is further discussed in Section 2.5, was verbally approved by the USEPA on October 7, 1994.
- Depths to LNAPL and water were measured at shorter intervals (i.e., at approximately three times the specified frequency). This change was made because more accurate and/or reliable results were expected at shorter time intervals based on the results from monitoring wells MW-5S and G106SL.

2.5

LIGHT NONAQUEOUS PHASE LIQUID SAMPLE COLLECTION

LNAPL samples were collected from piezometers P19, P20, and P21 for laboratory analysis to determine the characteristics of LNAPL. The sampling procedures, which were verbally approved by the USEPA on October 7, 1994, differ from the SAP in that a peristaltic pump and Tygon tubing were used instead of a bailer to maximize the volume of the collected samples. During the RI, LNAPL samples that were collected with a bailer emulsified into the water and dispersed into the filter pack. As a result, an insufficient volume of LNAPL was available to perform all of the required analyses. The use of a peristaltic pump resulted in the collection of sufficient sample to permit: (1) the splitting of a sample from P19 with ~~B&V~~ the USEPA ARCS contractor, and (2) the collection of a duplicate sample and a matrix spike/matrix spike duplicate sample from P20. The specific sampling procedure that was followed during the collection of the LNAPL samples is as follows:

- The interface probe and peristaltic pump weight were decontaminated by using an Alconox wash and a distilled water rinse.
- Depths to water and LNAPL were measured with the interface probe.
- A decontaminated stainless steel weight was affixed to the end of a new, translucent, 3/8-inch-diameter, Tygon tube.

- Approximately 1,000 ml of distilled water were pumped through the tubing to decontaminate the inside of the tube. Afterwards, the pump was run until the tubing was dry.
- The weight and tubing were lowered into the piezometer to a depth midway between the top of the LNAPL and the top of the water, as determined from depth measurements.
- The peristaltic pump was activated and the LNAPL was dispensed directly from the tubing into the jars supplied by Quanterra.
- The split sample was collected by alternately filling jars for each analysis. A representative of ~~B&V~~ the USEPA ARCS contractor indicated that the split sample was to be submitted to a USEPA-contracted laboratory in accordance with their Work Plan.

During the LNAPL investigation, two additional facies were identified at the site, and the direction of ground water flow was reevaluated by using the collected depth-to-water measurements. As indicated in the following subsections, the newly identified facies do not affect the site hydrogeology, and the southeasterly ground water flow direction observed throughout the investigation is consistent with the flow direction reported in the RI.

3.1

SITE GEOLOGY

The two additional facies observed during this investigation include the clayey-silt and miscellaneous backfill facies shown on Figures 3-1 and 3-2. These figures depict the piezometric surface obtained from the depth to water measurements collected on November 8, 1994. Because of the limited distribution and the variable properties of these facies, no geotechnical data have been collected for incorporation into the ground water flow model to be used for the FS.

Clayey-Silt Facies

The clayey-silt facies, which is interpreted to be a backwater or lake deposit related to the Des Plaines River, is characterized by dark greenish-gray, clayey silts, with abundant gastropod shells and rooting. This facies was observed at only three piezometer locations (i.e., P01, P05, and P07) at depths between 8 and 12 feet BGS and overlain by the silty-clay facies.

Miscellaneous Backfill Facies

As discussed in the RI Report, two fill facies, including excavation backfill and silty-sand backfill, were delineated at the site. During the LNAPL investigation, miscellaneous backfill materials that are not related to the previously identified backfill facies were encountered at piezometers P07, P08, and P13. This facies, which is limited in areal extent and horizontally discontinuous, is typically characterized by broken concrete and dolomite cobbles and may be locally saturated. A backfilled basement was found at the location of P13.

SITE HYDROGEOLOGY

The hydrogeologic information obtained during the LNAPL evaluation is consistent with the data presented in the RI. However, during the LNAPL investigation, additional hydrogeologic information was obtained regarding the presence of confined aquifer conditions south of Jeans Road and the variation of the surficial aquifer's piezometric surface through time.

The surficial aquifer is locally subject to confined conditions where the silty-clay facies directly overlies the dolomite bedrock. At locations G102S, P23, and P24, and P24S, ground water was not encountered above the bedrock during drilling; however, the water level subsequently rose above the bedrock upon encountering the saturated zone or shortly after well installation. At locations G102S and P26, the weathered limestone bedrock residuum at the top of bedrock provides an additional confining layer, and the water table was not encountered until the drilling using hollow stem augers extended 5 and 7 feet into the bedrock, respectively. Subsequently, the water level in each monitoring well rose above the saturated zone, as noted during drilling. In addition, ground water was not encountered while augering 1 foot into bedrock at locations P19 and P20. After auger refusal at the depth of 1 foot into bedrock, the P19 and P20 borings were completed using water rotary drilling. The water levels on the piezometers rose above bedrock in these piezometers after their installation. The bedrock residuum appears to act as an additional confining layer at these locations. In each of these cases, water levels in the completed piezometers were above the level at which ground water was encountered during drilling, indicating that the aquifer is confined or semi-confined at locations P19, P20, P23, P24, P24S, and G102S.

Table 3-1 summarizes the piezometric surface elevations interpreted from data collected from August 19 through November 8, 1994. The piezometric surface elevations were corrected for the density of LNAPL by using the procedures described in the approved RI Report.

The piezometric surfaces shown on the computer-generated maps included in Appendix F are consistent with the information obtained during the RI. These maps were generated by utilizing a commonly used software entitled SURFER. These maps, which are derived from water level measurements obtained at the site over a 13-week period show that the ground water flows southeast toward the Des Plaines River.

The computer-generated maps of the piezometric surface on November 1 and 8, 1994, show a change in ground water flow direction towards the south near the Des Plaines River, while the southeastern flow direction across the site is nearly unchanged. During these two weeks, there is an approximately 2 to 3-foot rise in the water table southeast of Jeans Road

indicating an increase in aquifer recharge caused by excessive precipitation. These variances of flow direction near the river are attributed to changes in river level combined with ground water infiltration patterns caused by the increased precipitation. Based on the piezometric surface elevations at monitoring wells G101M and MW-3S, the average horizontal hydraulic gradient is 0.0039 ft/ft and ranged from 0.0014 ft/ft on November 1, 1994 to 0.0055 ft/ft on August 26, 1994. These values are similar to those reported in the RI (i.e., an average horizontal hydraulic gradient of 0.0035 ft/ft which ranged from a low of 0.0009 ft/ft on October 30, 1991 to a high of 0.0053 ft/ft on June 24, 1991). The piezometric surface maps show that the hydraulic gradient is steepest near Jeans Road, immediately southeast of the site. The steepening of the hydraulic gradient in the area of Jeans Road is likely attributable to the sharp downward slope of the land surface in this area. As shown on Figure 3-1, a 6-foot drop in ground elevation occurs between piezometers P19 and P26, while the ground elevation between P06 and P19 (i.e., from a location near the ditch to just south of Jeans Road) is essentially flat.

EXTENT, THICKNESS, AND PHYSICAL CHARACTERISTICS OF THE LIGHT NONAQUEOUS PHASE LIQUID

The extent of measurable LNAPL on the water table, its apparent and true thicknesses, and its physical characteristics are described in this section. As indicated in the FSP, these data will be used to model an LNAPL recovery system during the FS.

4.1

EXTENT OF LIGHT NONAQUEOUS PHASE LIQUID

The extent of the LNAPL at the site was determined by: (1) identifying the presence or absence of measurable LNAPL in each shallow monitoring well or piezometer by using an interface probe, and (2) examining soil boring logs for the borings installed in and around the main excavation area during both the RI and the LNAPL investigation. The maximum observed apparent product thickness at each monitoring well and piezometer in which LNAPL was observed during this investigation and the RI are shown on Figure 4-1. As illustrated on this figure, Figure 4-2 two areally distinct portions of the site, designated as LNAPL Areas 1 and 2, contained measurable amounts of LNAPL. A detailed cross section of the main excavation area is provided on Figure 4-23.

LNAPL Area 1, which has the thicker and more extensive LNAPL, was estimated to cover approximately 39,100 square feet based on the areal extent of the LNAPL shown in Figure 4-22. The limits of this LNAPL area were defined by: (1) the presence of LNAPL in monitoring wells MW-5S and G106L, and piezometers P13, P15, P16, P19, P20, and P21; and (2) the absence of LNAPL in monitoring wells G102L, MW-2S, MW-4S, and MW-8S, and piezometers G102S, P14, P23, P24, P24S, P25, and P26. Occasional droplets of what appeared to be an oily substance were observed in water collected from piezometers P24 and P24S during initial well development. No measurable LNAPL accumulated in these piezometers during the duration of the study. As shown in Figure 4-23, the approximate boundaries of LNAPL Area 1 extend from the southeastern border of the excavated area to 100 feet southeast of Jeans Road. The northwestern limit of the LNAPL is inferred to be the southeastern border of the main excavation for the following reasons:

- The LNAPL occurs in unconsolidated sediments southeast of the main excavation as indicated by soil samples collected during the installation of monitoring wells G106SL and MW-5S and piezometers P13 and P14. Because the ~~unconsolidated~~ ~~sediments~~ contaminated soils were removed from the main excavation and incinerated by the IEPA in an effort to mitigate the

immediate threat to human health and the environment, LNAPL-contaminated soils and undoubtedly LNAPL existing as free product, were also removed ~~to remove the LNAPL~~ during the initial remedial activities as indicated in the RI Report, ~~no~~ Thus, LNAPL is not expected to be present within the main excavation area.

- In general, the elevation of the piezometric surface is above the base of the main excavation as shown in Figure 4-23. However, the Visqueen liner would prevent the LNAPL from flowing into the area of the main excavation.
- Field observations noted during the installation of piezometer P01 indicate that the LNAPL is most prevalent in the soils above the water at depths between 2 to 8 feet. These LNAPL saturated soils were removed from the main excavation area during the initial remedial activities, and the LNAPL remaining in the area of P01 is trapped by the water impinging on the Visqueen liner.

The LNAPL in Area 1 is present in the unconsolidated gravels overlying the bedrock in about 52 percent of the area (i.e., north of Jeans Road) and in the dolomite bedrock in the rest of the area.

The LNAPL is subject to confined aquifer conditions in limited areas south of Jeans Road where the ground surface slopes down towards the Des Plaines River at a steeper gradient than the piezometric surface. The presence of LNAPL in a confined aquifer suggests that historical water levels at the site were lower than present day water levels because the transition area between unconfined and confined conditions would inhibit downgradient migration of the LNAPL. The downgradient migration of the LNAPL is retarded by increasing water pressures at the water table as the aquifer changes from unconfined to confined. As the pressure increases downgradient, the LNAPL will stay in the unconfined portion of the aquifer because the lower density LNAPL will move towards the lower pressure areas. It is likely that the LNAPL was entrapped initially during a period of lower water table (i.e., lower river levels, low precipitation, or extreme ground water withdrawal) which permitted the LNAPL to migrate to its current location. Subsequently, a rise in the ground water table resulted in confined conditions in the aquifer southeast of Jeans Road, preventing further downgradient migration of LNAPL from the site.

LNAPL Area 2 is confined to an area immediately adjacent to piezometer P01. This area was not excavated during the initial remedial activities because of the existence of the subsequently abandoned monitoring well cluster G105. As indicated in the RI Report, soils were excavated and incinerated in all directions away from the G105 well cluster. Thus, the

extent of the LNAPL in Area 2 is limited to the soils immediately surrounding the G105 well cluster that were not excavated during initial remediation activities. The absence of LNAPL in the soil and piezometers at locations P05, P06, P07, P08, and P09 confirm that the LNAPL is not present to the northwest, northeast, and southwest of the main excavation. As indicated previously, LNAPL-stained soils extend from approximately 2 to 8 feet BGS in Area 2 as shown in the soil boring log for piezometer P01. Therefore, Area 2, which is estimated to cover 707 square feet, contains approximately 235 cubic yards of LNAPL-contaminated soil. These calculations are based on soil contamination down to the water table, which was encountered at 9 feet BGS, and an estimated radius of impacted soils of approximately 15 feet.

As shown on Tables 4-1 and 4-2, the apparent LNAPL thicknesses increased for a period of 2 to 3 weeks after installation; and bail-down testing occurred when the apparent LNAPL thickness in each piezometer or well was at or near its maximum. An exception is piezometer P21, whose apparent thickness at the time of bail-down testing was approximately 60 percent of its maximum measured apparent thickness. In addition, water level data summarized in Table 3-1 show that the water table elevation of G106L and MW-5S was below 592.5 feet AMSL, which is the elevation noted in the FSP at which LNAPL begins to be observed in the site wells also indicating that the capillary fringe is exposed. The thick accumulation of LNAPL in the piezometers and the low water table indicates that the capillary fringe containing free-phase LNAPL was not submerged during bail-down testing.

4.2

THICKNESS OF LIGHT NONAQUEOUS PHASE LIQUID

As shown on Table 4-1, the apparent LNAPL thicknesses measured during this investigation ranges ~~from 0.03 feet to~~ up to 2.52 feet. The LNAPL has been thickest and most consistently observed in monitoring wells MSW-5S and G106L and in piezometers P19, P20, and P21. The maximum apparent thickness of the LNAPL in each well or piezometer is shown on **Figure 4-1** and summarized on **Table 4-2**.

As discussed in Section 2.4, bail-down tests were performed to estimate the true thickness of the LNAPL at the site. The methodology for the bail-down tests was presented in the FSP and is consistent with the procedure included in "Volume Determination and Recoverability of Free Hydrocarbon" by Testa and Paczkowski (Ground Water Monitoring Review, Winter 1989, Page 120). The technique is directly applicable to monitoring wells MW-5S and G106L and piezometer P01 because the LNAPL is present in unconsolidated soils at these locations. In addition,

the technique is also applicable to piezometer P21 even though the LNAPL is present in the dolomite bedrock for the following reasons:

- The aquifer is unconfined at this location permitting the formation of a capillary fringe;
- The dolomite is extremely fractured and weathered near the surface at the site, resulting in increased permeability and porosity; and
- The resulting increased permeability and porosity from weathering results in the formation of intercrystalline pore spaces, which would increase the thickness of the capillary fringe.

Thus, the fractured bedrock near the surface more likely mimics a poorly sorted gravel than a well-indurated rock mass with no intergranular or intercrystalline porosity and widely spaced joints or fractures that are not well connected.

The bail-down test technique is not directly applicable to piezometers P19 and P20 because ~~the aquifer is confined at these locations and a capillary fringe will not form.~~ Instead, LNAPL accumulates at the P19 and P20 locations because the aquifer is confined at these locations and the lower water pressure at the air/water contact in the piezometer results in a pressure gradient that forces the lower density LNAPL to flow to the piezometer. ~~The bail-down technique does not account for this flow mechanism.~~ Rather, it is based upon identifying free-phase LNAPL flow from the capillary fringe zone into the well or piezometer which accumulates and/or causes a depression in the water table. The bail-down tests were conducted prior to installation of piezometers P24S and G102S, which confirmed the presence of confined conditions in the aquifer.

Depth-to-water values from each test were plotted versus time, and the true product thickness was determined from the thickness of the LNAPL at the time where the depth-to-water curve passes through the inflection point (i.e., when the depth-to-water curve changes from an increasing curve to a decreasing curve). The bail-down test results are presented in Appendix E and summarized on Table 4-2. Based on the bail-down test results, the true thickness of the LNAPL in Area 1 ranges from 0.023 feet at P1921 to 0.14 feet in monitoring well MSW-5S.

As shown on Figure 4-1 and summarized on Table 4-2, the maximum apparent LNAPL thickness in Area 2 (i.e., piezometer P01) is 0.35 feet and the true LNAPL thickness is 0.01 feet.

The volumes of LNAPL present in the two areas defined during this investigation have been estimated to be about 7,600 ~~9,148~~ and 20 gallons in Areas 1 and 2, respectively. These values were obtained by using the following assumptions:

- **Area 1**

- Surface area = 39,100 square feet.
- LNAPL thickness = 0.0785 feet (average of the minimum and maximum true thicknesses).
- Aquifer porosity = 0.368 (from Section 3.6.2 of the RI Report. The porosity of the top of the dolomite was not determined but is probably less than that of the unconsolidated materials from which 0.368 was determined. Thus, 0.368 represents a conservative value for determining the volume of the LNAPL).

- **Area 2**

- Surface Area = 707 square feet.
- LNAPL thickness = 0.01 feet.
- Aquifer porosity = 0.368 (from Section 3.6.2 of the RI Report).

The FSP proposed utilizing the computer model Areal Multiphase Organic Simulator (ARMOS) to empirically ~~predict the true estimate~~ the volume of LNAPL in the formation and the volume of recoverable LNAPL. During a technical status meeting on August 11, 1994, the preliminary findings of the LNAPL study were discussed with representatives of the USEPA and ~~B&V~~ the USEPA ARCS contractor, specifically dealing with the occurrence of LNAPL in the fractured bedrock southeast of Jeans Road.

The discussion concluded with a consensus that the ARMOS modeling **would not be included** in this Technical Memorandum since ARMOS is not able to automatically account for the fractured bedrock setting. However, it is the intent of the Lenz Oil Participating Respondents to attempt to enhance ARMOS to include it along with the ground water modeling to be conducted for the Revision 1 of the FS. These enhancements (if any can be identified) will be presented as part of the discussions relating to the ground water modeling effort scheduled for February 16, 1995. **Rather, the modeling results are included as part of the ground water modeling effort in the FS.**

PHYSICAL CHARACTERISTICS

According to the field observations, the LNAPL is a **viscous, brown, oily substance that emanates a strong petroleum-like odor**. Samples of the LNAPL were collected from piezometers P19, P20, and P21 and analyzed for specific gravity and viscosity to obtain additional information for the evaluation of various remedial alternatives. As shown on Table 4-3, the specific gravity of the LNAPL samples ranged from 0.86 to 0.87, and are consistent with the specific gravities of 0.87 and 0.88 obtained from LNAPL samples collected during the RI from monitoring wells MS-5S and G106L, respectively. In all cases, the specific gravity of the LNAPL is lower than that of the ground water.

The viscosity of the LNAPL samples was measured at 50°F, 100°F, 150°F, and 200°F to determine the effects of increased temperatures. As shown in Table 4-3, the viscosity of each LNAPL sample decreased with increasing temperature. At 50°F, the viscosity ranged from 28.4 to 40 centistokes (cSt) and at 200°F ranged from 3.1 to 4.0 cSt. **These viscosity variations will be examined during the FS to determine whether heating the LNAPL to promote its recoverability is a feasible remedial alternative.**

The analytical results of the soil and LNAPL samples collected during the LNAPL investigation are described in the following subsections, and copies of the validated data tables are included in Appendix G.

5.1

SOIL SAMPLES

Subsurface soil samples were collected from five piezometer locations (i.e., P01, P06, P08, P13, and P24S) at the Lenz Oil site from the 2-foot interval above the water table to determine if those samples had been contaminated with LNAPL. All of these samples were analyzed for the following analytical parameters:

- Target Compound List (TCL) volatile organic compounds (VOCs),
- TCL semivolatile organic compounds (SVOCs),
- TCL pesticides and polychlorinated biphenyls (PCBs), and
- Target Analyte List (TAL) total metals and cyanide.

The analytical results for these soil samples are summarized on Table 5-1 and shown on Figures 5-1 through 5-4.

5.1.1

Volatile Organic Compounds

As shown on Table 5-1 and Figure 5-1, TCL VOCs were detected in all five soil samples, but toluene was the only TCL VOC detected at the location of piezometer P08. The TCL VOCs detected in one or more of the other soil samples were acetone; 1,1-dichloroethane; total 1,2-dichloroethene; 1,1,1-trichloroethane; 2-butanone; trichloroethene; benzene; tetrachloroethene; toluene; chlorobenzene; ethyl benzene; and total xylenes (Table 5-1). The total concentrations of TCL VOCs in the soil samples ranged from 2 µg/kg at piezometer P08 to 1,916 µg/kg at piezometer P24S.

With the exception of chlorobenzene, all of the TCL VOCs detected during the LNAPL investigation were previously found at similar levels during the RI activities. Chlorobenzene was only present at one location (i.e., P01) at an estimated concentration of 6 J µg/kg. In addition, benzene was the only TCL VOC that was found at a greater concentration (i.e., 93 J µg/kg at location P24S) than the highest detected concentration during the RI (i.e., 39 µg/kg at location SB07).

5.1.2 *Semivolatile Organic Compounds*

During the LNAPL investigation, TCL SVOCs were identified in all of the soil samples at total concentrations ranging from 317 $\mu\text{g}/\text{kg}$ at P13 to 46,700 $\mu\text{g}/\text{kg}$ at P01. Piezometer P01 is located within an unexcavated area of the main excavation area, where LNAPL was observed when the former G105 monitoring well cluster was removed during the RI sampling activities. The TCL SVOCs detected in one or more of the soil samples were 1,2-dichlorobenzene; naphthalene; 2-methylnaphthalene; 3-nitroaniline; n-nitrosodiphenylamine; fluorene; phenanthrene; di-n-butylphthalate; and bis(2-ethylhexyl)phthalate.

The TCL SVOCs 3-nitroaniline and n-nitrosodiphenylamine were detected at only one location during the LNAPL investigation at concentrations of 97 J and 1,900 J $\mu\text{g}/\text{kg}$, respectively, but were not detected during the RI. The remaining TCL SVOCs were detected at levels lower than the highest concentrations found during the RI.

5.1.3 *Pesticides and Polychlorinated Biphenyls*

The results of the pesticide/PCB analysis on the soil samples are shown on Table 5-1 and Figure 5-3. Pesticides were not detected in any of the soil samples. However, PCBs (i.e., Aroclors) were detected at four of the five soil sample locations (i.e., P01, P06, P08, and P24S), with total concentrations ranging from 49 $\mu\text{g}/\text{kg}$ in the sample from P24 to 16,700 $\mu\text{g}/\text{kg}$ in the sample from location P06. The PCBs detected in two or more of the soil samples were Aroclor-1242, Aroclor-1248, Aroclor-1254, and Aroclor-1260. With the exception of the soil sample from P06, the total PCB concentrations of each soil sample are less than 2,000 $\mu\text{g}/\text{kg}$.

The PCB concentrations detected during the LNAPL investigation are similar in magnitude to the PCB concentrations found during the RI, and the greatest concentration of each detected PCB was less than the greatest concentration of the respective PCB detected during the RI.

5.1.4 *Inorganics*

The results of the total metals and cyanide analyses of the soil samples are presented in Table 5-1 and in Figure 5-4. In comparison to the background values presented in Table 4-17 of the RI, the soil samples from P08, P13, and P24 exceeded the range of background values for calcium and magnesium only. However, the soil samples from P01 and P06 exceeded the range of background values for all of the detected inorganics except for manganese. The soil sample from P06 also had an elevated concentration of silver, which was not detected in the background samples. Selenium was the only inorganic detected at a greater level (i.e., 4.5 mg/kg at location P01) than the highest concentration detected during

the RI (i.e., 2.8 J mg/kg at location SB20). Cyanide was not detected in any of the samples collected during the LNAPL investigation.

5.2 *LIGHT NONAQUEOUS PHASE LIQUID SAMPLES*

The LNAPL samples collected from piezometers P19, P20, and P21 were submitted to Quanterra for analysis of TCL VOCs, SVOCs, and pesticides/PCBs; TAL total metals; cyanide; toxicity characteristic leaching procedure (TCLP) organics and inorganics; specific gravity; viscosity; and gas chromatography fingerprinting. A summary of the laboratory results and the validated data tables are provided in Table 5-2 and Appendix G, respectively. As indicated in the laboratory report included as Appendix H, TCLP extracts were only analyzed for herbicides because no solids were present in the laboratory filters for any of the samples after the completion of the initial filtration step and therefore, the results of the TCLP and TCL/TAL analyses would have been the same. Because herbicides are not TCL parameters, it was necessary for the laboratory to perform the TCLP analyses for herbicides. This approach was verbally approved by the USEPA on October 24, 1994.

5.2.1 *Volatile Organic Compounds*

As shown on Figure 5-5 and Table 5-2, several TCL VOCs were detected at elevated concentrations in the LNAPL samples. The sample from piezometer P19 contained the most TCL VOCs and the highest concentrations of many of the contaminants (i.e., a total TCL VOC concentration of 15,980,000 $\mu\text{g/kg}$), and the sample from piezometer P21 contained the lowest TCL VOC concentrations of all of the samples (i.e., a total VOC concentration of 485,420 $\mu\text{g/kg}$). As shown on Figure 5-5, piezometer P19 is closer to the site than the other two sampled piezometers. The TCL VOCs detected in one or more of the LNAPL samples include acetone; 1,1-dichloroethene; 1,1-dichloroethane; total 1,2-dichloroethene; 1,1,1-trichloroethane; trichloroethene; benzene; tetrachloroethene; toluene; ethyl benzene; and total xylenes. The LNAPL samples from piezometers P19 and P20 contained higher concentrations of toluene, ethyl benzene, and total xylenes than the other TCL VOCs, while the LNAPL sample from piezometer P21 exhibited only total xylenes at a higher concentration than the rest of the TCL VOCs detected in the sample.

Of the TCL VOCs detected in the LNAPL samples, only toluene, ethyl benzene, and total xylenes were detected during the RI, and the levels reported in the RI are approximately one order of magnitude lower. Acetone; 1,1-dichloroethene; 1,1-dichloroethane; and trichloroethene were detected in only one of the three LNAPL samples. Tetrachloroethene was detected in two of the three LNAPL samples. Total 1,2-dichloroethene;

1,1,1-trichloroethane; benzene; toluene; ethyl benzene; and total xylenes were detected in all three LNAPL samples.

5.2.2 *Semivolatile Organic Compounds*

As shown on Table 5-2 and Figure 5-6, the TCL SVOCs that were detected in the LNAPL samples included naphthalene, 2-methylnaphthalene, acenaphthene, fluorene, phenanthrene, and bis(2-ethylhexyl)phthalate. With the exception of acenaphthene, which was only found in the sample from P19, all of the detected TCL SVOCs were found in all of the samples collected from piezometers P12, P20, and P21. Total TCL SVOC concentrations ranged from 4,920,000 $\mu\text{g}/\text{kg}$ in the sample from P21 to 5,160,000 $\mu\text{g}/\text{kg}$ in the sample from P20. The lowest concentration of each TCL SVOC detected during the LNAPL investigation is greater than the highest concentration detected during the RI.

5.2.3 *Pesticides, Polychlorinated Biphenyls, and Herbicides*

As indicated on Table 5-2 and Figure 5-7, pesticides and herbicides were not detected in any of the LNAPL samples. However, two PCBs (i.e., Aroclor-1242 and Aroclor-1260) were detected in all of the LNAPL samples. The total PCB concentrations in the LNAPL samples obtained from piezometers P19, P20, and P21 are 248,000; 238,000; and 107,000 $\mu\text{g}/\text{kg}$, respectively. The same two PCBs were detected during the RI, but at lower total concentrations (i.e., 36,000 $\mu\text{g}/\text{kg}$ at MW-5S and 52,000 $\mu\text{g}/\text{kg}$ at G106L).

5.2.4 *Inorganics*

The inorganic analytes detected in the LNAPL samples are shown on Table 5-2 and Figure 5-8. Detectable concentrations of 12 TAL metals (i.e., aluminum, arsenic, barium, calcium, chromium, copper, iron, lead, manganese, selenium, vanadium, and zinc) were found in at least one of the three LNAPL samples. The detected inorganics were of the same order of magnitude as those detected during the RI. However, the concentrations of three inorganic analytes (i.e., aluminum, lead, and selenium) slightly exceeded levels detected during the RI.

The most significant results of the LNAPL investigation conducted at the Lenz Oil site between August 1 and November 8, 1994 can be summarized as follows:

- Two separate, distinct areas of LNAPL contamination were found, one inside the main excavation area at the former location of the G105 well cluster, and another beginning at the southeastern end of the main excavation area and extending about 100 feet southeast of Jeans Road.
- The analytical data for soil samples collected during this investigation are not significantly different from the data collected during the RI. The concentrations of organics in the LNAPL samples were higher than those detected during the RI.

TABLES

TABLE 1-1

**CHRONOLOGY OF FIELD ACTIVITIES DURING THE
LIGHT NONAQUEOUS PHASE LIQUID INVESTIGATION
LENZ OIL SITE
LEMONT, ILLINOIS
(Page 1 of 2)**

Date	Completed Activity (1)	Samples Collected		Comments
		Medium	Location	
08/01/94 to 08/12/94	Installation of piezometers at the following 13 locations: P01 P05 P06 P07 P08 P09 P13 P14 P15 P16 P19 P20 P21	Soil	P01 P06 P08 P13	Piezometers P15, P16, P19, P20, and P21 were installed in bedrock after securing the USEPA's approval. LNAPL was detected in the following outer boundary piezometers: P19, P20, and P21. The installation of additional piezometers (i.e., piezometers P23, P24, P25, and P26) was approved by the USEPA in a meeting on September 7, 1994 .
	No installation of piezometers at the following 9 locations: P02 P03 P04 P10 P11 P12 P17 P18 P22	None	None	Piezometers were not installed at locations P02, P03, P04, P10, P11, and P12 because ground water was not encountered above the visqueen liner inside the excavation area . In addition, piezometers were not installed at locations P17, P18, and P22 because ground water was not encountered above the bedrock.
08/19/94	Collection of water level data.	None	None	Water levels were recorded for all piezometers and shallow monitoring wells.
08/26/94	Collection of water level data. Completion of bail-down tests at G106L and MW-5S.	None	None	Water levels were recorded for all piezometers and shallow monitoring wells.
09/02/94	Collection of water level data.	None	None	Water levels were recorded for all piezometers and shallow monitoring wells.
09/09/94	Collection of water level data.	None	None	Water levels were recorded for all piezometers and shallow monitoring wells.

TABLE 1-1

**CHRONOLOGY OF FIELD ACTIVITIES DURING THE
LIGHT NONAQUEOUS PHASE LIQUID INVESTIGATION
LENZ OIL SITE
LEMONT, ILLINOIS
(Page 2 of 2)**

Date	Completed Activity (1)	Samples Collected		Comments
		Medium	Location	
09/12/94 to 09/13/94	Installation of four additional piezometers at the following locations: P23 P24 P25 P26	None	None	LNAPL has not been detected in any of these piezometers. Therefore, the extent of the LNAPL at the site has been delineated. However, because confined aquifer conditions were found at P24 and the boring log for G102L indicated that the top of the screen has been below the water table since it was installed, the USEPA approved the installation of two additional piezometers at these two locations during an October 7, 1994 meeting at the site.
09/16/94	Collection of water level data.	None	None	Water levels were recorded for all piezometers and shallow monitoring wells.
09/23/94	Collection of water level data.	None	None	Water levels were recorded for all piezometers and shallow monitoring wells.
09/30/94	Collection of water level data.	None	None	Water levels were recorded for all piezometers and shallow monitoring wells.
10/07/94	Collection of water level data.	None	None	Water levels were recorded for all piezometers and shallow monitoring wells.
10/13/94	Collection of LNAPL samples. Completion of bail-down tests at piezometers P19, P20, and P21.	LNAPL	P19 P20 P21	Sufficient LNAPL was available in the piezometers to permit the collection of split samples by the USEPA contractor, and the collection of duplicate, matrix spike, and matrix spike duplicate samples.
10/14/94	Installation of piezometers at two additional locations: P24S G102S	Soil	P24S	The piezometers were installed with the screen straddling the water table. Confined conditions were confirmed at P24 and at G102S. No LNAPL has been measured at either location, although droplets of LNAPL were occasionally observed in the development water of P24S.
10/25/94	Collection of water level data.	None	None	Water levels were recorded for all piezometers and shallow monitoring wells.
11/01/94	Collection of water level data. Survey of new piezometers.	None	None	Water levels were recorded for all piezometers and shallow monitoring wells.
11/08/94	Collection of water level data.	None	None	Water levels were recorded for all piezometers and shallow monitoring wells.

Note:

(1) See Figure 1-1 for piezometer locations.

Key:

LNAPL = Light nonaqueous phase liquid.

USEPA = U.S. Environmental Protection Agency.

TABLE 2-1

**PIEZOMETER AND SHALLOW MONITORING WELL CONSTRUCTION SUMMARY
LENZ OIL SITE
LEMONT, ILLINOIS**

Location (1)	Grid Location		Elevation of Top of Casing (feet AMSL)	Elevation of Grade (feet AMSL)	Depth to Top of Screen (feet)	Depth to Bottom of Screen (feet)	Elevation of Top of Screen (feet AMSL)	Elevation of Bottom of Screen (feet AMSL)
	Northings (feet)	Easting (feet)						
G101M	887	362	612.05	608.40	18.53	23.53	589.87	584.87
G102L	417	477	601.63	599.50	11.26	13.28	588.24	586.22
G102S	412	474	601.82	600.46	5.00	15.00	595.46	585.46
G106S	507	237	603.08	601.00	6.50	11.50	594.50	589.50
MW-1S	713	615	602.88	600.40	3.50	13.50	596.90	586.90
MW-2S	551	608	603.23	600.28	3.00	13.00	597.28	587.28
MW-3S	18	582	597.99	594.91	3.00	13.00	591.91	581.91
MW-4S	655	501	603.35	600.55	3.55	13.55	597.00	587.00
MW-5S	508	424	603.92	600.07	6.00	16.00	594.07	584.07
MW-6S	62	211	594.04	593.60	1.25	11.25	592.35	582.35
MW-8S	550	142	602.48	599.70	5.65	15.65	594.05	584.05
P01	686	303	603.03	600.30	6.00	16.00	594.30	584.30
P05	726	380	602.84	600.09	4.50	11.50	595.59	588.59
P06 (2)	759	292	603.65	600.74	4.00	9.00	596.74	591.74
P07	705	197	600.55	598.84	4.00	14.00	594.84	584.84
P08	623	166	600.81	598.76	4.50	10.50	594.26	588.26
P09	640	468	603.62	600.82	5.00	15.00	595.82	585.82
P13	506	371	603.78	601.68	8.50	14.75	593.18	586.93
P14	509	291	603.69	600.94	8.00	15.00	592.94	585.94
P15	473	238	601.34	601.65	8.00	20.00	593.65	581.65
P16	484	429	604.20	601.74	8.00	20.00	593.74	581.74
P19	420	339	604.18	601.28	8.00	20.00	593.28	581.28
P20	379	260	599.29	599.68	8.00	20.00	591.68	579.68
P21	367	376	601.03	598.49	5.00	17.00	593.49	581.49
P23	485	198	600.87	601.19	8.72	18.72	592.47	582.47
P24 (3)	304	195	596.28	595.76	7.46	17.46	588.30	578.30
P24S	303	199	596.18	595.41	3.50	13.50	591.91	581.91
P25	303	301	597.95	595.66	6.29	16.29	589.37	579.37
P26	311	439	598.23	596.00	5.99	18.49	590.01	577.51

Notes:

- (1) The piezometers installed as part of the LNAPL investigation are shaded. All of the other locations consist of monitoring wells that were already present at the site.
- (2) The well casing was cut 0.18 foot from the original top-of-casing elevation of 603.83 feet AMSL to permit the placement of a PVC slip cap on September 12, 1994.
- (3) The well casing was cut 0.63 foot from the original top-of-casing elevation of 596.91 feet AMSL during a rework of the well top on October 14, 1994.

Key:

AMSL = Above mean sea level.
 LNAPL = Light nonaqueous phase liquid.
 PVC = Polyvinyl chloride.

TABLE 3-1
PIEZOMETRIC SURFACE ELEVATIONS
LENZ OIL SITE
LEMONT, ILLINOIS
(Page 1 of 2)

Location	8/19/94			8/26/94			9/2/94			9/9/94			9/16/94		
	Depth to Oil (feet)	Depth to Water (feet)	Corrected Piezometric Surface (1) (feet AMSL)	Depth to Oil (feet)	Depth to Water (feet)	Corrected Piezometric Surface (1) (feet AMSL)	Depth to Oil (feet)	Depth to Water (feet)	Corrected Piezometric Surface (1) (feet AMSL)	Depth to Oil (feet)	Depth to Water (feet)	Corrected Piezometric Surface (1) (feet AMSL)	Depth to Oil (feet)	Depth to Water (feet)	Corrected Piezometric Surface (1) (feet AMSL)
G101M		18.51	593.54		18.92	593.13		18.93	593.12		19.33	592.72		19.55	592.50
G102L		10.84	590.79		11.49	590.14		11.31	590.32		11.71	589.92		11.96	589.67
G102S															
G106L	10.81	13.27	591.98	11.31	13.83	591.47	11.49	11.50	591.59	11.81	12.76	591.16	12.15	13.24	590.80
MW-1S		9.32	593.56		9.92	592.96		10.05	592.83		10.45	592.43		10.37	592.51
MW-2S		10.31	592.92		10.90	592.33		10.97	592.26		11.33	591.90		11.14	592.09
MW-3S		8.40	589.59		9.83	588.16		8.78	589.21		8.95	589.04		9.12	588.87
MW-4S		9.96	593.39		10.62	592.73		10.66	592.69		11.12	592.23		11.39	591.96
MW-5S	10.99	11.95	592.82	11.63	12.66	592.17	11.63	12.47	592.19	12.11	12.92	591.71	12.47	13.34	591.35
MW-6S		3.49	590.55		4.48	589.56		4.29	589.75		4.97	589.07		4.75	589.29
MW-8S		9.21	593.27		9.70	592.78		9.75	592.73		9.92	592.56		10.28	592.20
P01		9.45	593.58		10.01	593.02		10.03	593.00		10.43	592.60	10.81	11.03	592.19
P05		9.19	593.65		9.77	593.07		9.80	593.04		10.21	592.63		10.60	592.24
P06		9.67	594.16		10.33	593.50		10.54	593.29		10.99	592.84		11.15	592.50
P07		7.04	593.51		7.58	592.97		7.60	592.95		Dry			8.39	592.16
P08		7.28	593.53		7.79	593.02		7.79	593.02		8.26	592.55		8.67	592.14
P09		10.40	592.22		10.97	592.65		11.02	592.60		11.40	592.22		11.81	591.81
P13		10.97	592.81		11.61	592.17		11.57	592.21	12.05	12.08	591.73	12.40	12.42	591.38
P14		11.42	592.27		12.03	591.66		11.98	591.71		12.40	591.29		12.69	591.00
P15		10.22	591.12		10.75	590.59		10.70	590.64	11.00	11.02	590.34	11.23	11.24	590.11
P16		12.41	591.79		13.04	591.16		12.99	591.21		13.41	590.79	13.70	13.73	590.50
P19	13.60	13.64	590.58	14.09	14.70	590.02	13.87	15.43	590.12	14.21	16.53	589.69	14.29	16.74	589.60
P20	8.56	8.57	590.73	8.50	9.23	590.70	9.25	9.75	589.98	9.45	10.38	589.73	9.68	11.13	589.44
P21		10.63	590.40	11.18	12.36	589.71	10.93	12.27	589.94	11.26	12.96	589.57	11.43	13.06	589.40
P23	--	--	--	--	--	--	--	--	--	--	--	--		10.40	590.47
P24	--	--	--	--	--	--	--	--	--	--	--	--		7.70	589.21
P24S	--	--	--	--	--	--	--	--	--	--	--	--			
P25	--	--	--	--	--	--	--	--	--	--	--	--		8.68	589.27
P26	--	--	--	--	--	--	--	--	--	--	--	--		8.71	589.52

TABLE 3-1
PIEZOMETRIC SURFACE ELEVATIONS
LENZ OIL SITE
LEMONT, ILLINOIS
 (Page 2 of 2)

Location	9/23/94			9/30/94			10/7/94			10/25/94			11/1/94			11/8/94		
	Depth to Oil (feet)	Depth to Water (feet)	Corrected Piezometric Surface (1) (feet AMSL)	Depth to Oil (feet)	Depth to Water (feet)	Corrected Piezometric Surface (1) (feet AMSL)	Depth to Oil (feet)	Depth to Water (feet)	Corrected Piezometric Surface (1) (feet AMSL)	Depth to Oil (feet)	Depth to Water (feet)	Corrected Piezometric Surface (1) (feet AMSL)	Depth to Oil (feet)	Depth to Water (feet)	Corrected Piezometric Surface (1) (feet AMSL)	Depth to Oil (feet)	Depth to Water (feet)	Corrected Piezometric Surface (1) (feet AMSL)
G101M		18.73	593.32		19.30	592.75		19.56	592.49		19.65	592.40		18.93	593.12		17.99	594.06
G102I		11.89	589.74		11.66	589.97		11.97	589.66		12.03	589.60		9.05	592.58		8.57	593.06
G102S											12.19	589.63		9.22	592.60		8.75	593.07
G106L	12.13	13.28	590.81	11.77	12.95	591.17	12.05	13.37	590.87	12.18	13.61	590.73	10.53	11.68	592.41	9.75	11.09	593.17
MW-1S		10.85	592.03		10.56	592.32		10.82	592.06		11.00	591.88		9.72	593.16		8.64	594.24
MW-2S		11.54	591.69		11.47	591.76		11.72	591.51		11.87	591.36		9.75	593.48		9.00	594.23
MW-3S		8.96	589.03		8.88	589.11		9.12	588.87		9.01	588.98		6.11	591.88		5.70	592.29
MW-4S		11.63	591.72		11.10	592.25		11.46	591.89		11.68	591.67		10.40	592.95		9.31	594.04
MW-5S	12.57	13.30	591.26	12.08	12.77	591.76	12.41	13.23	591.41	12.59	13.43	591.23	10.91	11.26	592.97	9.85	10.55	593.99
MW-6S		4.67	589.37		4.48	589.56		4.75	589.29		4.61	589.43		1.68	592.36		1.53	592.51
MW-8S		10.25	592.23		9.92	592.56		10.31	592.17		10.50	591.98		9.68	592.80		8.75	593.73
P01	10.80	11.15	592.19	10.37	10.67	592.62	10.68	10.99	592.31	11.00	11.29	592.00	10.00	10.17	593.01	9.00	9.04	594.03
P05		9.51	593.33		10.13	592.71		11.46	591.38		10.70	592.14		9.55	593.29		8.53	594.31
P06 (2)		11.34	592.31		10.85	592.80		11.21	592.44		11.39	592.26		10.76	592.89		8.84	594.81
P07		8.37	592.18		7.94	592.61		8.26	592.29		8.47	592.08		7.57	592.98		6.59	593.96
P08		8.65	592.16		8.07	592.74		8.52	592.29		8.72	592.09		7.02	593.79		6.62	594.19
P09		11.89	591.73		11.43	592.19		11.76	591.86		11.94	591.68		10.85	592.77		9.52	594.10
P13	12.54	12.59	591.23		11.96	591.82	12.32	12.32	591.46	12.50	12.54	591.28		10.83	592.95		9.68	594.10
P14		12.75	590.94		12.30	591.39		12.64	591.05		12.82	590.87		10.79	592.90		10.11	593.58
P15	11.19	11.22	590.15	11.92	11.93	589.42	11.21	11.24	590.13	11.32	11.33	590.02		9.16	592.18		8.58	592.76
P16	13.74	13.78	590.46	13.36	13.37	590.84	13.65	13.67	590.55	13.78	13.84	590.41		11.71	592.49		9.73	594.47
P19	14.31	16.50	589.61	14.14	16.45	589.76	14.29	16.45	589.63	14.45	16.28	589.51	12.06	12.48	592.07	11.57	12.05	592.55
P20	9.58	11.25	589.51	9.36	10.93	589.74	9.52	11.58	589.52	9.80	10.44	589.41	7.14	8.15	592.03	6.63	8.25	592.47
P21	11.55	12.46	589.37	11.20	12.28	589.70	11.50	12.53	589.41	11.61	12.30	589.34	8.78	9.02	592.22	8.43	8.68	592.57
P23		10.37	590.50		10.08	590.79		10.35	590.52		10.48	590.39		9.57	591.30		7.92	592.95
P24		7.63	589.28		7.45	589.46		7.68	589.23		7.09	589.19		4.39	591.89		3.99	592.29
P24S											6.90	589.28		4.06	592.12		3.74	592.44
P25		8.63	589.32		9.38	588.57		8.67	589.28		8.61	589.34		5.79	592.16		5.34	592.61
P26		8.61	589.62		8.43	589.80		8.69	589.54		8.75	589.48		5.90	592.33		5.32	592.91

Note:

(1) Piezometric surface elevations were corrected for wells with measureable LNAPL by using a specific gravity of LNAPL = 0.875

Key:

LNAPL = Light nonaqueous phase liquid.

AMSL = Above mean sea level.

— = Not installed

Blank

space = No LNAPL was detected at this location.

TABLE 4-1
APPARENT LIGHT NONAQUEOUS PHASE LIQUID THICKNESS
LENZ OIL SITE
LEMONT, ILLINOIS

Location	8/19/94 Apparent LNAPL Thickness (feet)	8/26/94 Apparent LNAPL Thickness (feet)	9/2/94 Apparent LNAPL Thickness (feet)	9/9/94 Apparent LNAPL Thickness (feet)	9/16/94 Apparent LNAPL Thickness (feet)	9/23/94 Apparent LNAPL Thickness (feet)	9/30/94 Apparent LNAPL Thickness (feet)	10/7/94 Apparent LNAPL Thickness (feet)	10/25/94 Apparent LNAPL Thickness (feet)	11/1/94 Apparent LNAPL Thickness (feet)	11/8/94 Apparent LNAPL Thickness (feet)
G106L (1)	2.46	2.52	0.01	0.95	1.09	1.15	1.18	1.32	1.43	1.15	1.34
MW-5S (1)	0.96	1.03	0.84	0.81	0.87	0.73	0.69	0.82	0.84	0.35	0.70
P01 (2)	0.00	0.00	0.00	0.00	0.22	0.35	0.30	0.31	0.29	0.17	0.04
P13	0.00	0.00	0.00	0.03	0.02	0.05	0.00	0.00	0.04	0.00	0.00
P15	0.00	0.00	0.00	0.02	0.01	0.03	0.01	0.03	0.01	0.00	0.00
P16	0.00	0.00	0.00	0.00	0.03	0.04	0.01	0.02	0.06	0.00	0.00
P19 (2)	0.04	0.61	1.56	2.32	2.45	2.19	2.31	2.16	1.83	0.42	0.48
P20 (2)	0.01	0.73	0.50	0.93	1.45	1.67	1.57	2.06	0.64	1.01	1.62
P21 (2)	0.00	1.18	1.34	1.70	1.63	0.91	1.08	1.03	0.69	0.24	0.25

Notes:

- (1) Bail-down test conducted on August 26, 1994.
- (2) Bail-down test conducted on October 13, 1994.

Key:

LNAPL = Light nonaqueous phase liquid.

TABLE 4-2

**SUMMARY OF APPARENT AND TRUE THICKNESSES
OF THE LIGHT NONAQUEOUS PHASE LIQUID AT THE SITE
LENZ OIL SITE
LEMONT, ILLINOIS**

Location	Minimum Apparent LNAPL Thickness (feet)	Maximum Apparent LNAPL Thickness (feet)	Average Apparent LNAPL Thickness (1) (feet)	Apparent LNAPL Thickness at Time of Bail-down Test (feet)	True LNAPL Thickness (2) (feet)
G106L	0.01	2.52	1.33	2.52	0.09
MW-5S	0.35	1.03	0.79	1.01	0.14
P01	0.00	0.35	0.15	0.30	0.01
P13	0.00	0.05	0.01	NT	NT
P15	0.00	0.03	0.01	NT	NT
P16	0.00	0.06	0.01	NT	NT
P19 (3)	0.04	2.45	1.49	2.17	NA
P20 (3)	0.01	2.06	1.11	1.81	NA
P21	0.00	1.70	0.91	1.00	0.03

Notes:

- (1) Calculated as the arithmetic average of all thicknesses measured at the site.
- (2) Based on the results of bail-down tests.
- (3) Bailed down tests were conducted, but the results are invalid because the aquifer is confined at this location.

Key:

LNAPL = Light nonaqueous phase liquid.

NT = No test (i.e., no bail-down test was conducted at this location).

NA = Test was not applicable.

TABLE 4-3

SUMMARY OF LIGHT NONAQUEOUS PHASE LIQUID PHYSICAL CHARACTERISTICS
LENZ OIL SITE
LEMONT, ILLINOIS

Piezometer Number Sample Name Date	P19 LONP19 10/13/94	P20 LONP20 10/13/94	P20 LONP20D 10/13/94	P21 LONP21 10/13/94
Analysis				
Specific Gravity	0.86	0.86	NA	0.87
Viscosity @ 50 degrees F (cSt)	35.9	28.4	40	32.9
Viscosity @ 100 degrees F (cSt)	10.0	9.8	NA	9.4
Viscosity @ 150 degrees F (cSt)	5.2	5.1	NA	4.8
Viscosity @ 200 degrees F (cSt)	3.3	3.2	3.1	4

Key:

NA = Not analyzed.

F = Fahrenheit.

cSt = Centistokes.

TABLE 5-1
SUMMARY OF ANALYTICAL RESULTS - SOIL SAMPLES (1)
LENZ OIL SITE
LEMONT, ILLINOIS

Location Sample Designation Sample Depth (feet BGS) Collection Date	P01 LOSP01E (2) 8-10' 08/02/94	P06 LOSP06D 6-8' 08/02/94	P08 LOSP08D 6-8' 08/05/94	P13 LOSP13E 8-10' 08/03/94	P24 LOSP24E (3) 8-10' 10/14/94
Volatile Organics (ug/kg)					
Acetone	150 U	280	31 U	11 U	32 J
1,1-Dichloroethane	17 U	15 U	11 U	26	24
Total 1,2-Dichloroethene	17 U	15 U	11 U	170	140
1,1,1-Trichloroethane	17 U	15 U	11 U	11 U	17
2-Butanone	50	86	11 U	11 U	11 UJ
Trichloroethene	17 U	15 U	11 U	65	11 U
Benzene	33	16	11 U	14	93 J
Tetrachloroethene	17 U	15 U	11 U	1 J	11 U
Toluene	3 J	22	2 J	31	710 J
Chlorobenzene	6 J	15 U	11 U	11 U	11 U
Ethyl Benzene	350	85	11 U	1 J	160
Total Xylenes	720	570	11 U	7 J	740
Semivolatile Organics (ug/kg)					
1,2-Dichlorobenzene	800 J	2,400 U	3700 U	27 J	1,800 U
Naphthalene	1,600 J	2,400 U	3700 U	110 J	1,800 U
2-Methylnaphthalene	39,000	790 J	3700 U	180 J	1,600 J
3-Nitroaniline	5,700 U	2,400 U	3700 U	400 U	97 J
n-Nitrosodiphenylamine	5,700 U	2,400 U	1900 J	400 U	1,800 U
Fluorene	5,700 U	2,400 U	3700 U	400 U	200 J
Phenanthrene	5,300 J	2,400 U	3700 U	370 U	480 J
di-n-Butylphthalate	5,700 U	2,400 U	3700 U	400 U	240 J
bis(2-Ethylhexyl)phthalate	5,700 U	2,400 U	3700 U	400 U	3,200
Pesticides/PCBs (ug/kg)					
Aroclor-1242	290 U	9,800	37 UJ	37 U	49 J
Aroclor-1248	610	970 U	90 J	37 U	37 UJ
Aroclor-1254	600	6,900	59 J	37 U	37 U
Aroclor-1260	470	970 U	44 J	37 U	37 U
Inorganics (mg/kg)					
Aluminum	20,200 J	16,600 J	1,030 J	2,770 J	1,780
Arsenic	16.4 J	12.1 J	8.0 J	2.6 J	2.5
Barium	145	106	20 U	20 U	20 U
Beryllium	1.6 J	1.6 J	0.4 U	0.4 U	0.4 U
Calcium	8,160	7,780	157,000	154,000	166,000
Chromium	30.2	23.6	4.3 J	7.4	5.9 J
Cobalt	14.8	8.7	2.0 U	3.9	2.0 U
Copper	48.3	17.3	3.2	8.8	4.9
Iron	29,700	49,500	14,100	6,280	5,010
Lead	32.4 J	79.3 J	2.1 J	3.1 J	4
Magnesium	5,520	5,190	95,300	90,600	86,300
Manganese	322 J	152 J	342 J	266 J	197
Nickel	39.4 J	19.5 J	4.0 U	6.5 J	4.0 U
Potassium	3,060	2,040	479	970	702
Selenium	4.5	1.0	0.4 U	0.4 U	0.2 UJ
Silver	1.0 U	2.0	1.0 U	1.0 U	1.0 U
Sodium	722	749	400 U	400 U	400 U
Vanadium	41.7	43.0	2.0 U	5.6	4.3
Zinc	117	118	9.7 U	12.2 U	11.8

Notes:

- (1) Only the parameters detected in at least one sample are shown.
- (2) Because SVOCs were reanalyzed, indicated result is either: (1) the greater of two positive results, (2) the greater of two estimated results, or (3) the nonqualified, positive result if one of the values was estimated. The detection limits shown are the lower of the two analyses.
- (3) A dilution of the investigative sample for LOSP24E was analyzed for volatile organics. The reported result is either: (1) the greater of two positive results, (2) the greater of two estimated results, or (3) the nonqualified, positive result if one of the values was estimated. The detection limits shown are the lower of the two analyses.

Key:

BGS = Below ground surface.
 U = Not detected at the detection limit shown.
 J = Estimated.
 PCBs = Polychlorinated biphenyls.
 SVOCs = Semivolatile organic compounds.

TABLE 5-2

SUMMARY OF ANALYTICAL RESULTS
LIGHT NONAQUEOUS PHASE LIQUID SAMPLES (1)
LENZ OIL SITE
LEMONT, ILLINOIS

Location Sample Designation Collection Date	P19 LONP19 10/13/94	P20 LONP20 (2) 10/13/94	P21 LONP21 10/13/94
Volatile Organics (ug/L)			
Acetone	500,000 UJ	500,000 UJ	86,000 J
1,1-Dichloroethene	500,000 U	500,000 U	780 J
1,1-Dichloroethane	500,000 UJ	500,000 UJ	3,600 J
Total 1,2-Dichloroethene	460,000 J	140,000 J	39,000
1,1,1-Trichloroethane	290,000 J	370,000 J	28,000
Trichloroethene	500,000 U	86,000 J	500,000 U
Benzene	330,000 J	240,000 J	5,200
Tetrachloroethene	500,000 U	65,000 J	840 J
Toluene	4,400,000	3,100,000	49,000
Ethyl Benzene	2,000,000	1,300,000	43,000
Total Xylenes	8,500,000	6,200,000	230,000
Semivolatile Organics (ug/kg)			
Naphthalene	800,000	860,000 J	700,000 J
2-Methylnaphthalene	2,400,000	2,800,000	2,900,000
Acenaphthene	500,000 UJ	170,000 J	230,000 J
Fluorene	190,000 J	260,000 J	220,000 J
Phenanthrene	470,000 J	570,000 J	640,000 J
bis(2-Ethylhexyl)phthalate	660,000	500,000 J	230,000 J
Pesticides, PCBs, and Herbicides (ug/kg)			
Aroclor-1242	210,000 J	200,000 J	65,000 J
Aroclor-1260	38,000 J	38,000 J	42,000 J
Inorganics (mg/kg)			
Aluminum	22.3	20.9	20 U
Arsenic	5.0	3.5	2.7
Barium	168	165	121
Calcium	322	314	275
Chromium	6.5	6.3	6.1
Copper	2.0	2.0 U	3.9
Iron	54.4	44.7	71.7
Lead	146	150	81
Manganese	1.5	1.4	1.1
Selenium	0.2 UJ	0.2 UJ	0.46 J
Vanadium	3.2	3.7	2.6
Zinc	4.7	4.9	4.1

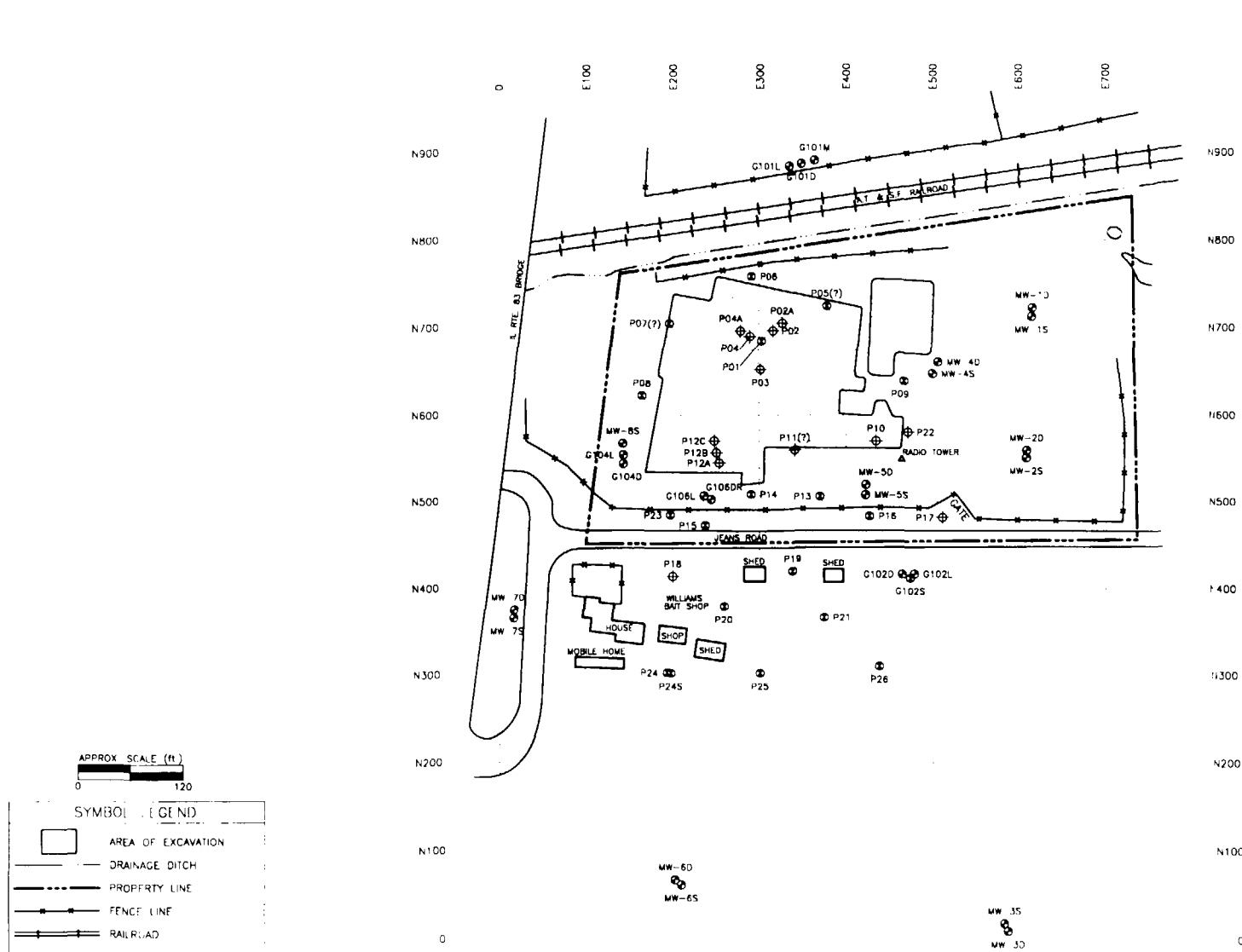
Notes:

- (1) Only the parameters that were detected in at least one sample are shown.
- (2) A field duplicate of the investigative sample LONP20 was collected and analyzed for the same parameters. The indicated result is either: (1) the greater of two positive results, (2) the greater of two estimated results, or (3) the nonqualified, positive result if one of the values was estimated. The detection limits shown are the lower of the two analyses.

Key:

- U = Not detected at the detection limit shown.
J = Estimated.
PCBs = Polychlorinated biphenyls.

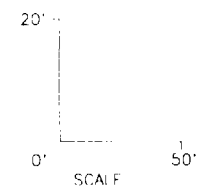
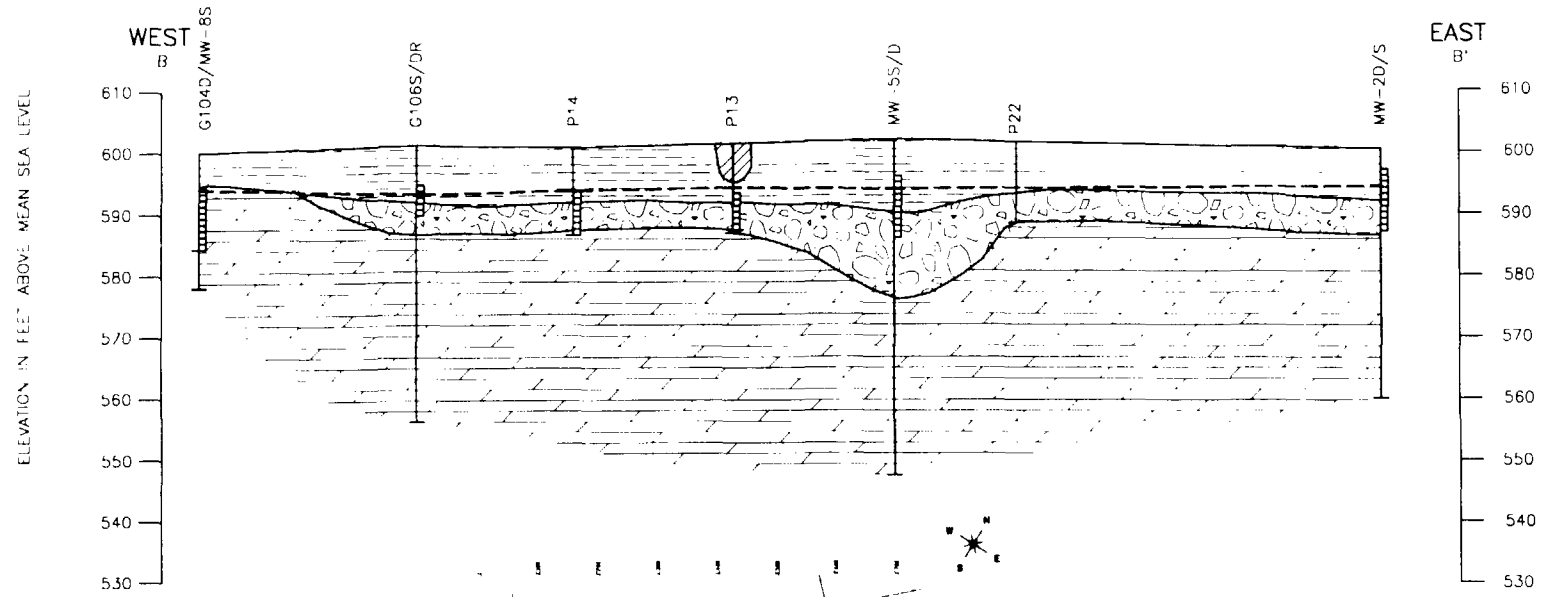
FIGURES



NOTE:
THE EXCAVATION BOUNDARIES ARE BASED ON SKETCHES PROVIDED BY THE ILLINOIS ENVIRONMENTAL PROTECTION AGENCY FOR THE REMEDIAL INVESTIGATION REPORT PREPARED BY ERM-NORTH CENTRAL, INC. ACCORDING TO FIELD OBSERVATIONS, PIEZOMETERS P05 AND P07 ARE OUTSIDE THE AREA OF THE MAIN EXCAVATION, AND PIEZOMETER P11 IS INSIDE THE AREA OF THE MAIN EXCAVATION.

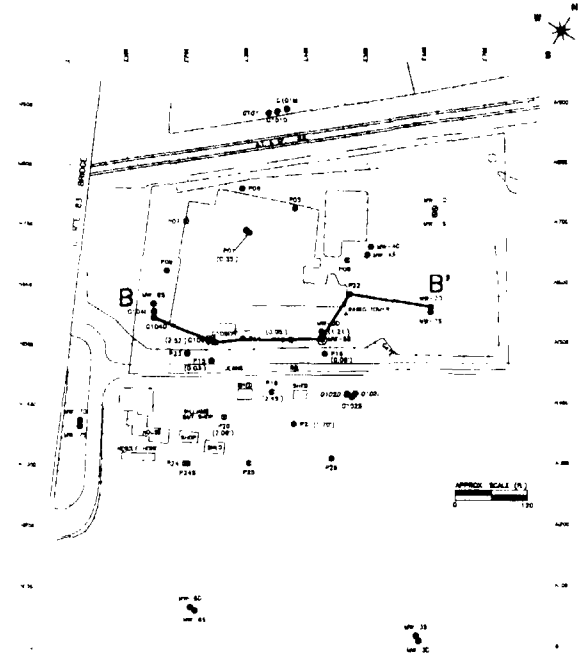
FIGURE 1-1
PIEZOMETER AND MONITORING WELL LOCATIONS
LIGHT NONAQUEOUS PHASE LIQUID INVESTIGATION
LENZ OIL SITE
LEMONT, ILLINOIS

1/5/95 GUN K:\CHFILES\ERNA\S&A\9407\06\ACAD\TMO\FIG3-2.DWG JAN 05, 1995 12:48 PM



VERTICAL EXAGGERATION - 2.5X

SYMBOL LEGEND	
	EXCAVATION BACKFILL
	MISCELLANEOUS BACKFILL FACIES
	SILTY CLAY FACIES
	SILTY-GRAVEL FACIES
	RACINE DOLOMITE FACIES
	PIEZOMETRIC SURFACE



CROSS SECTION LOCATION MAP

NOTES:
NO PIEZOMETER
INSTALLED AT P22 LOCATION.

SCREEN DEPTHS ARE
SHOWN FOR WATER
TABLE WELLS ONLY.

FIGURE 3-2
GEOLOGIC CROSS SECTION B-B'
LIGHT NONAQUEOUS PHASE LIQUID INVESTIGATION
LENZ OIL SITE
LEMONT, ILLINOIS



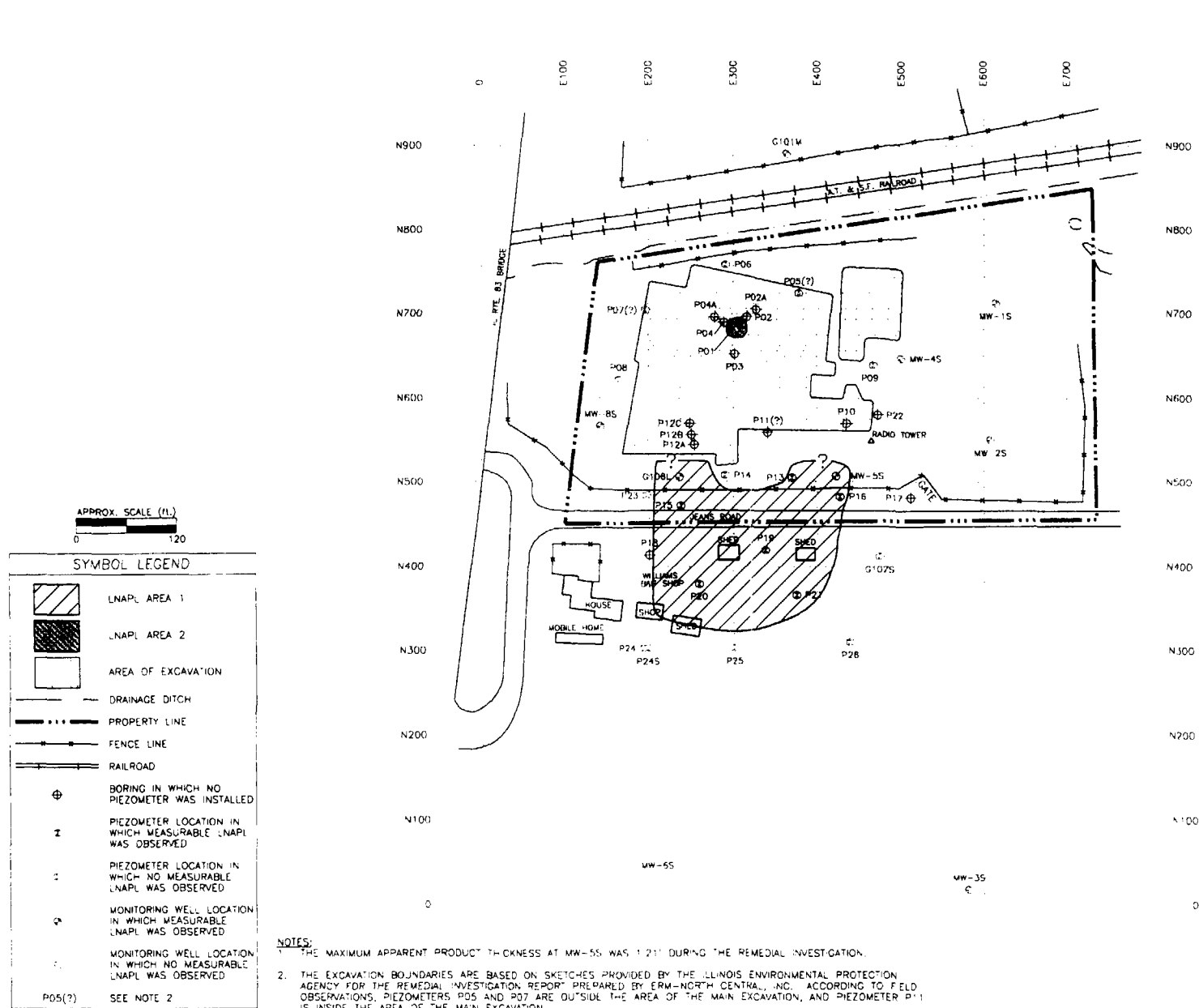
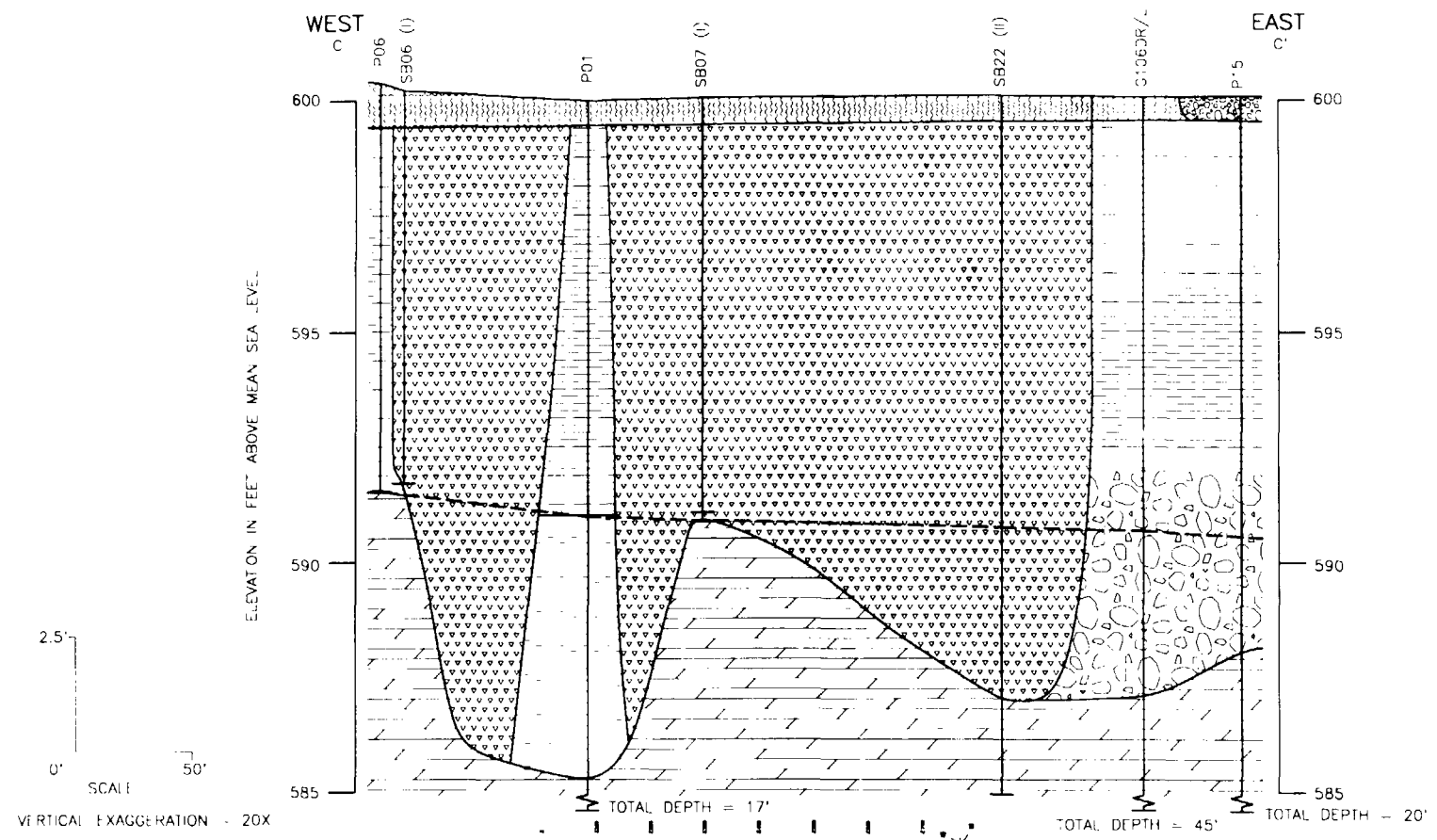
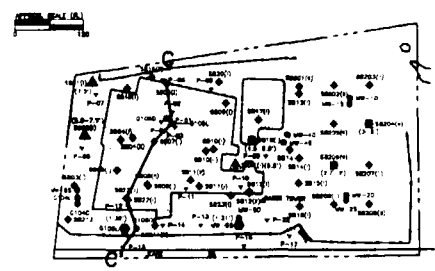


FIGURE 4-2
EXTENT OF LIGHT
NONAQUEOUS PHASE LIQUID
LENZ OIL SITE
LEMONT, ILLINOIS

3/20/95 C:\PE\LENA\S&A\9407\08\ACAD\DWG\FIG4-3.DWG MAR 20, 1995 1:13 PM



SYMBOL LEGEND	
[Pattern]	TOPSOIL
[Pattern]	EXCAVATION BACKFILL
[Pattern]	ROADBASE
[Pattern]	SILTY CLAY FACIES
[Pattern]	CLAYE-SILT FACIES
[Pattern]	SILTY-GRAVEL FACIES
[Pattern]	RACINE DOLOMITE FACIES
[Line]	PIEZOMETRIC SURFACE



CROSS SECTION LOCATION MAP

FIGURE 4-3
DETAILED HYDROGEOLOGIC CROSS SECTION C-C'
OF THE MAIN EXCAVATION
LIGHT NONAQUEOUS PHASE LIQUID INVESTIGATION
LENZ OIL SITE
LEMONT, ILLINOIS





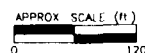
LOSP063	6'-8'
ACETONE	280
2-BUTANONE	86
BENZENE	15
TOLUENE	22
ETHYL BENZENE	85
TOTAL XYLENES	570

LOSP080	6'-8'
TOLUENE	2 J

LOSP24E	8'-10'
ACETONE	32 J
1,1-DICHLOROETHANE	24
TOTAL 1,2-DICHLOROETHANE	140
1,1,1-TRICHLOROETHANE	17
BENZENE	93 J
TOLUENE	710 J
ETHYL BENZENE	160
TOTAL XYLENES	740

LOSP01E	8'-10'
2-BUTANONE	50
BENZENE	33
TOLUENE	3 J
CHLOROBENZENE	5 J
ETHYL BENZENE	350
TOTAL XYLENES	720

LOSP13E	8'-10'
1,1-DICHLOROETHANE	26
TOTAL 1,2-DICHLOROETHANE	170
TRICHLOROETHANE	65
BENZENE	4
TETRACHLOROETHANE	1 J
TOLUENE	31
ETHYL BENZENE	1 J
TOTAL XYLENES	7 J



ALL CONCENTRATIONS SHOWN IN ug/kg.

SYMBOL LEGEND	
	AREA OF EXCAVATION
	DRAINAGE DITCH
	PROPERTY LINE
	FENCE LINE
	RAILROAD
	BORING IN WHICH NO PIEZOMETER WAS INSTALLED
	PIEZOMETER LOCATION
	MONITORING WELL LOCATION
	SEE NOTE

KEY:
J = ESTIMATED CONCENTRATION

SAMPLE NAME	SAMPLE DEPTH
PARAMETER	CONCENTRATION

NOTE:
THE EXCAVATION BOUNDARIES ARE BASED ON SKETCHES PROVIDED BY THE ILLINOIS ENVIRONMENTAL PROTECTION AGENCY FOR THE REMEDIAL INVESTIGATION REPORT PREPARED BY FRM-NORTH CENTRAL, INC. ACCORDING TO FIELD OBSERVATIONS. PIEZOMETERS P05 AND P07 ARE OUTSIDE THE AREA OF THE MAIN EXCAVATION, AND PIEZOMETER P11 IS INSIDE THE AREA OF THE MAIN EXCAVATION.

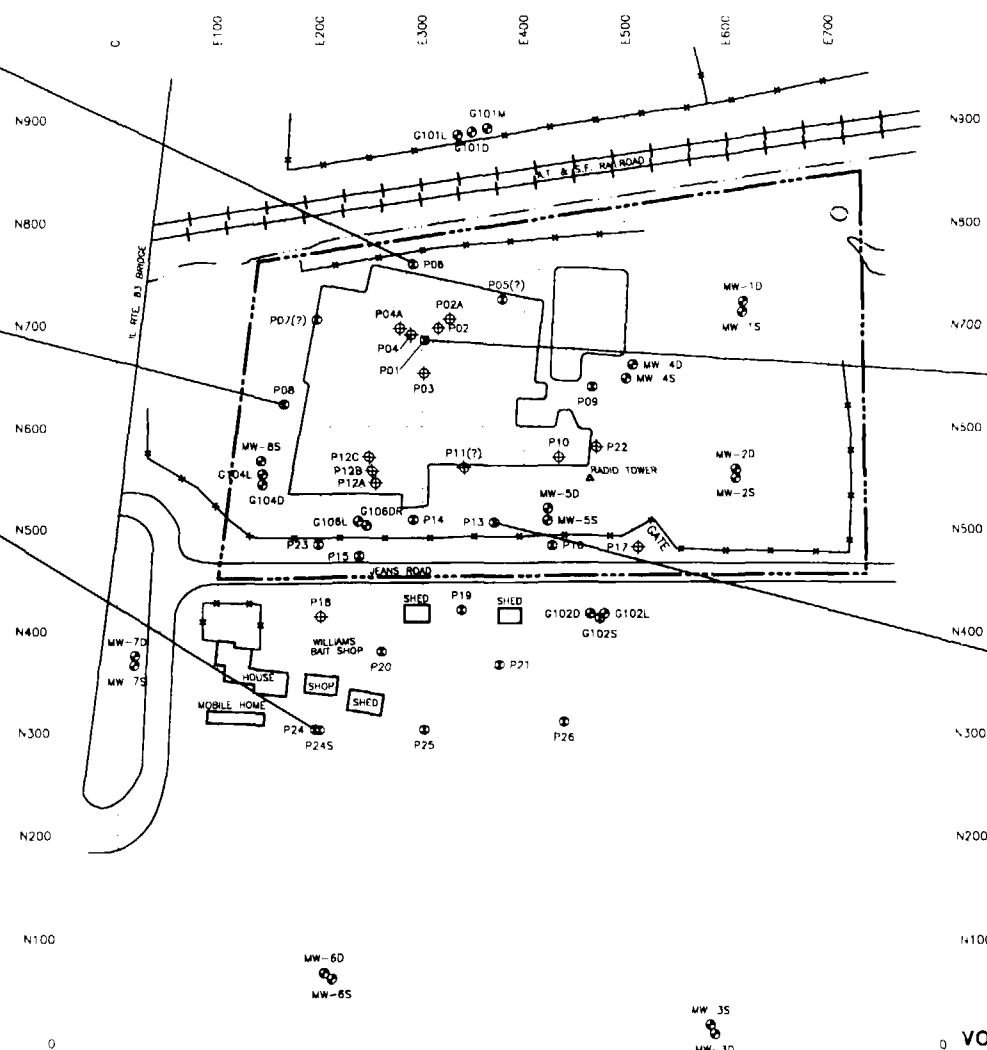
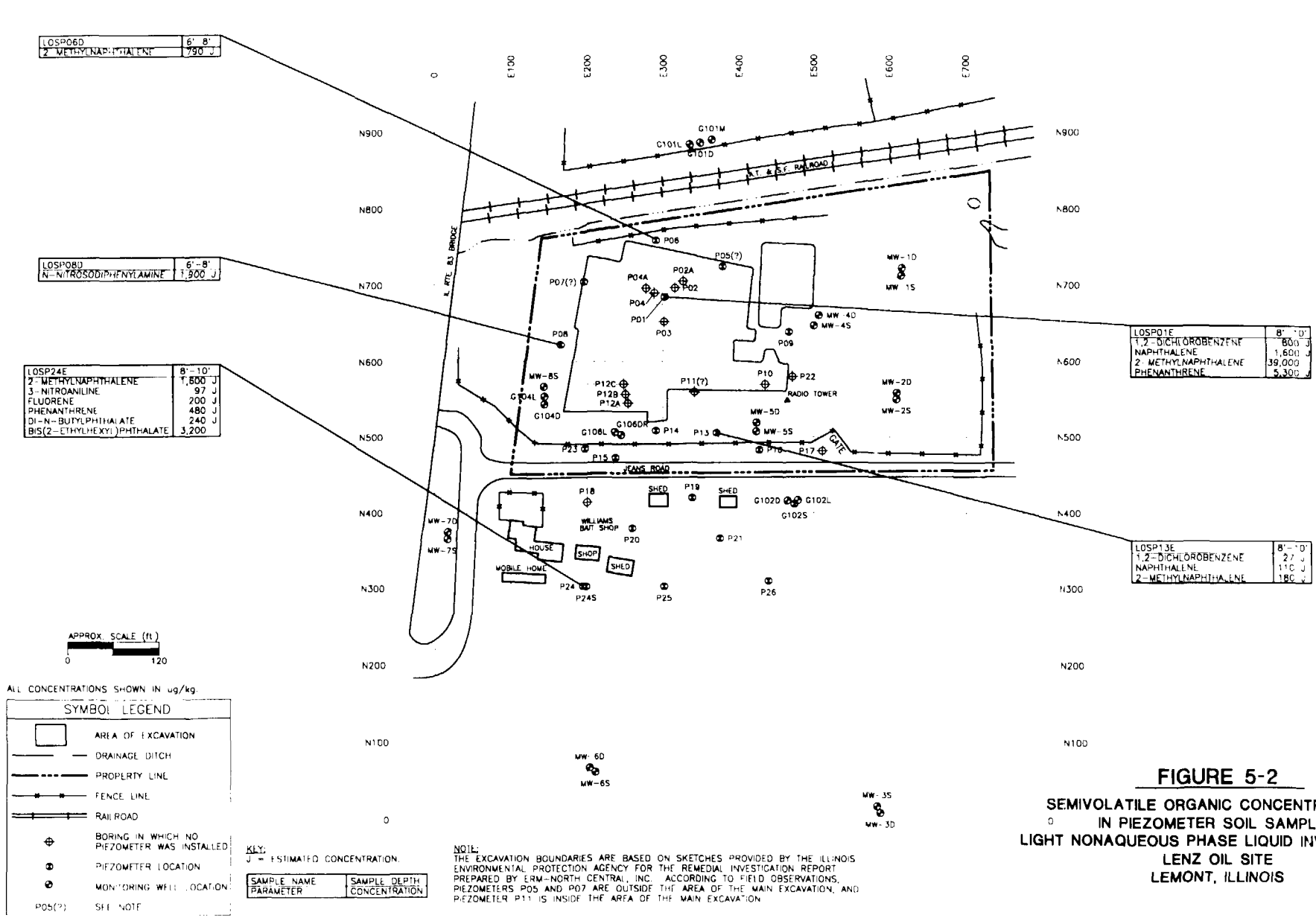


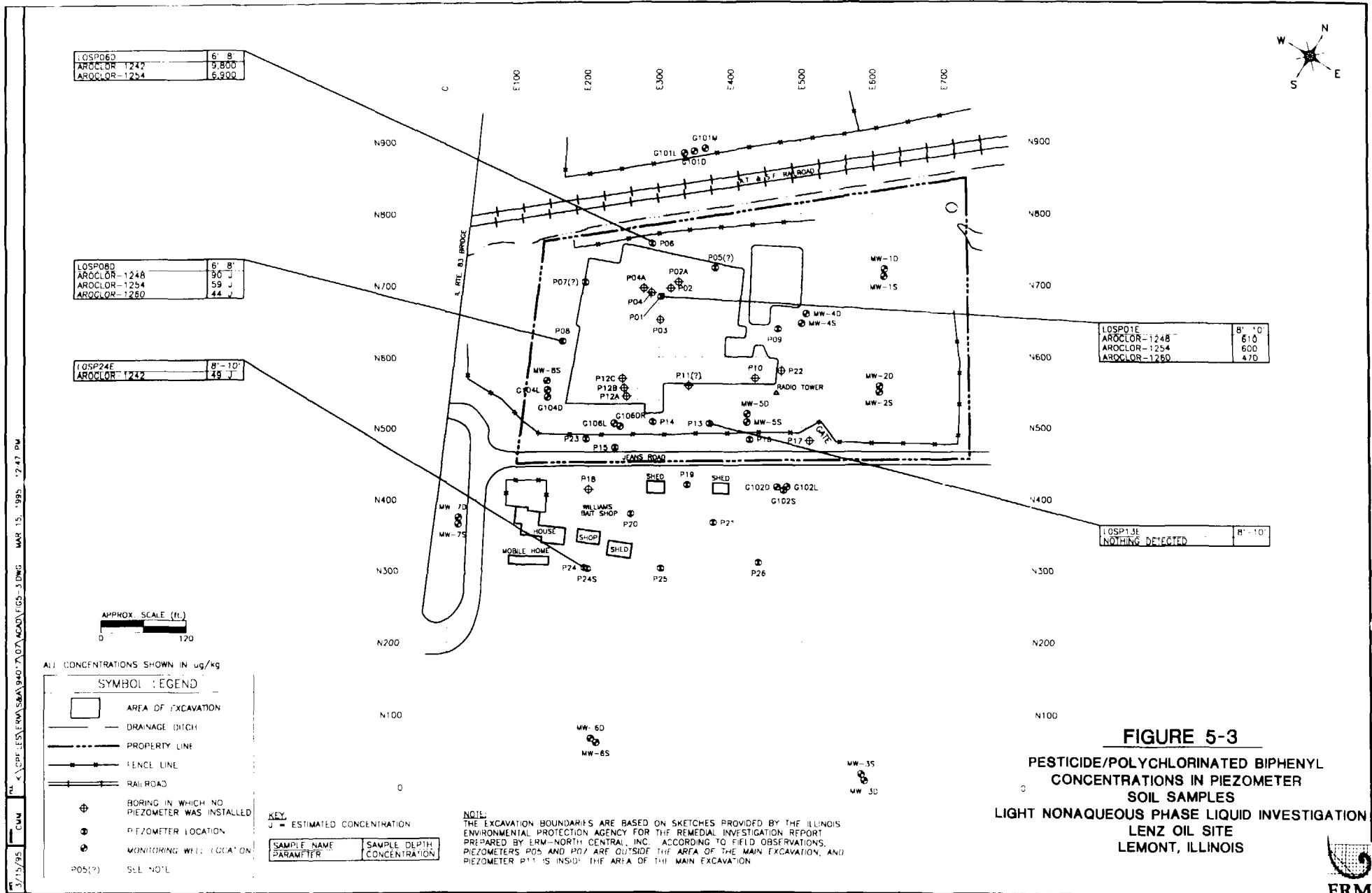
FIGURE 5-1

VOLATILE ORGANIC CONCENTRATIONS
IN PIEZOMETER SOIL SAMPLES
LIGHT NONAQUEOUS PHASE LIQUID INVESTIGATION
LENZ OIL SITE
LEMONT, ILLINOIS



1/5/95
K:\CP\LESS\ERMA\SBA\94017\0\ACAD\FIGS-2.DWG
MAR '95, 1995 12:56 PM
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3/15/95 4:01 PM K:\CP\LESS\ENR\S&A\340170\ACAD\FIGS-4.DWG MAR 15, 1995 12:36 PM

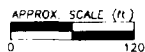
LOSP06D	6'-8"
ALUMINUM	16,600 J
ARSENIC	12.1 J
BARIIUM	106
BERYLLIUM	1.6 J
CALCIUM	7,780
CHROMIUM	23.6
COBALT	8.7
COPPER	17.3
IRON	49,500
LEAD	79.3 J
MAGNESIUM	5,190
MANGANESE	152 J
NICKEL	19.5 J
POTASSIUM	2,040
SELENIUM	1.0
SILVER	2.0
SODIUM	749
VANADIUM	43.0
ZINC	118

LOSP08D	6'-8"
ALUMINUM	1,030 J
ARSENIC	8.0 J
CALCIUM	157,000
CHROMIUM	4.3 J
COPPER	3.2
IRON	14,100
LEAD	2.1 J
MAGNESIUM	95,300
MANGANESE	342 J
POTASSIUM	479

LOSP24E	8'-10"
ALUMINUM	1,780
ARSENIC	2.5
CALCIUM	166,000
CHROMIUM	5.9 J
COPPER	4.9
IRON	5,010
LEAD	4
MAGNESIUM	86,300
MANGANESE	197
POTASSIUM	702
SODIUM	4.3
VANADIUM	11.8
ZINC	11.8

LOSP01E	8'-10"
ALUMINUM	20,200 J
ARSENIC	16.4 J
BARIIUM	145
BERYLLIUM	1.6 J
CALCIUM	8,160
CHROMIUM	30.2
COBALT	14.8
COPPER	48.3
IRON	29,700
LEAD	32.4 J
MAGNESIUM	5,520
MANGANESE	322 J
NICKEL	39.4 J
POTASSIUM	3,060
SELENIUM	4.5
SODIUM	722
VANADIUM	41.7
ZINC	11.7

LOSP13E	8'-10"
ALUMINUM	2,770 J
ARSENIC	2.6 J
CALCIUM	154,000
CHROMIUM	7.4
COBALT	3.9
COPPER	8.8
IRON	6,280
LEAD	3.1 J
MAGNESIUM	90,600
MANGANESE	266 J
NICKEL	8.5 J
POTASSIUM	970
VANADIUM	5.6



ALL CONCENTRATIONS SHOWN IN mg/kg

SYMBOL LEGEND

- AREA OF EXCAVATION
- DRAINAGE DITCH
- PROPERTY LINE
- FENCE LINE
- RAILROAD
- BORING IN WHICH NO PIEZOMETER WAS INSTALLED
- PIEZOMETER LOCATION
- MONITORING WELL LOCATION
- SEE NOTE

KEY
J = ESTIMATED CONCENTRATION

SAMPLE NAME	SAMPLE DEPTH
PARAMETER	CONCENTRATION

NOTE

THE EXCAVATION BOUNDARIES ARE BASED ON SKETCHES PROVIDED BY THE ILLINOIS ENVIRONMENTAL PROTECTION AGENCY FOR THE REMEDIAL INVESTIGATION REPORT PREPARED BY ERM-NORTH CENTRAL, INC. ACCORDING TO FIELD OBSERVATIONS, PIEZOMETERS P05 AND P07 ARE OUTSIDE THE AREA OF THE MAIN EXCAVATION, AND PIEZOMETER P11 IS INSIDE THE AREA OF THE MAIN EXCAVATION.

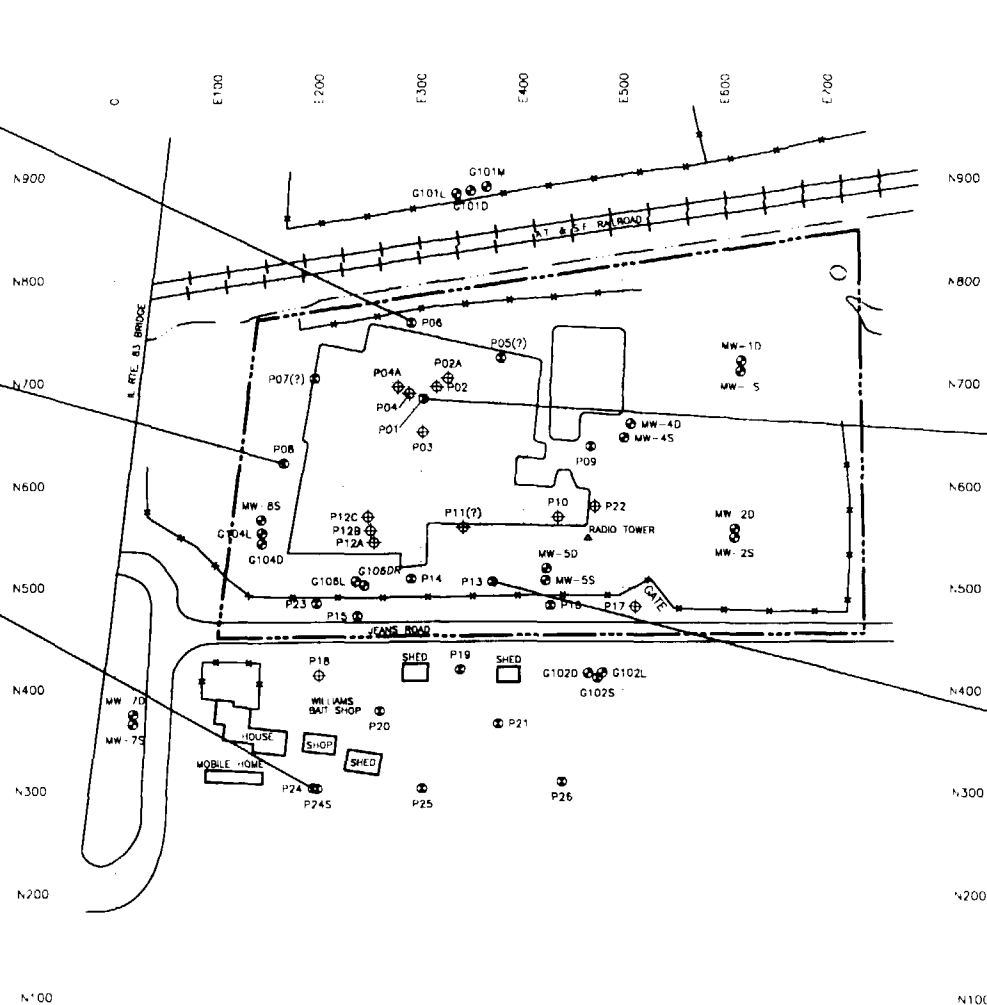


FIGURE 5-4
INORGANIC CONCENTRATIONS IN
PIEZOMETER SOIL SAMPLES
LIGHT NONAQUEOUS PHASE LIQUID INVESTIGATION
LENZ OIL SITE
LEMONT, ILLINOIS



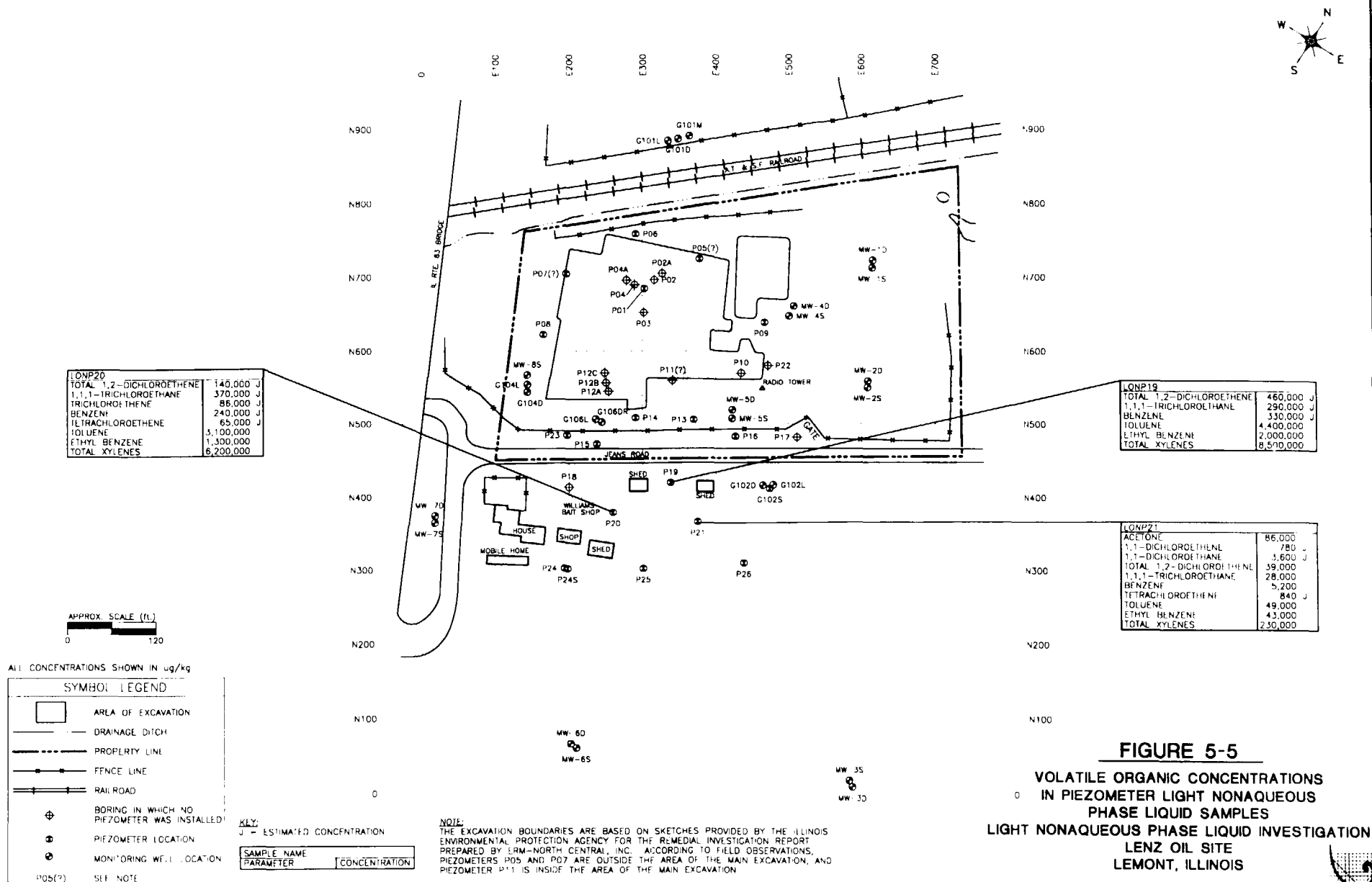
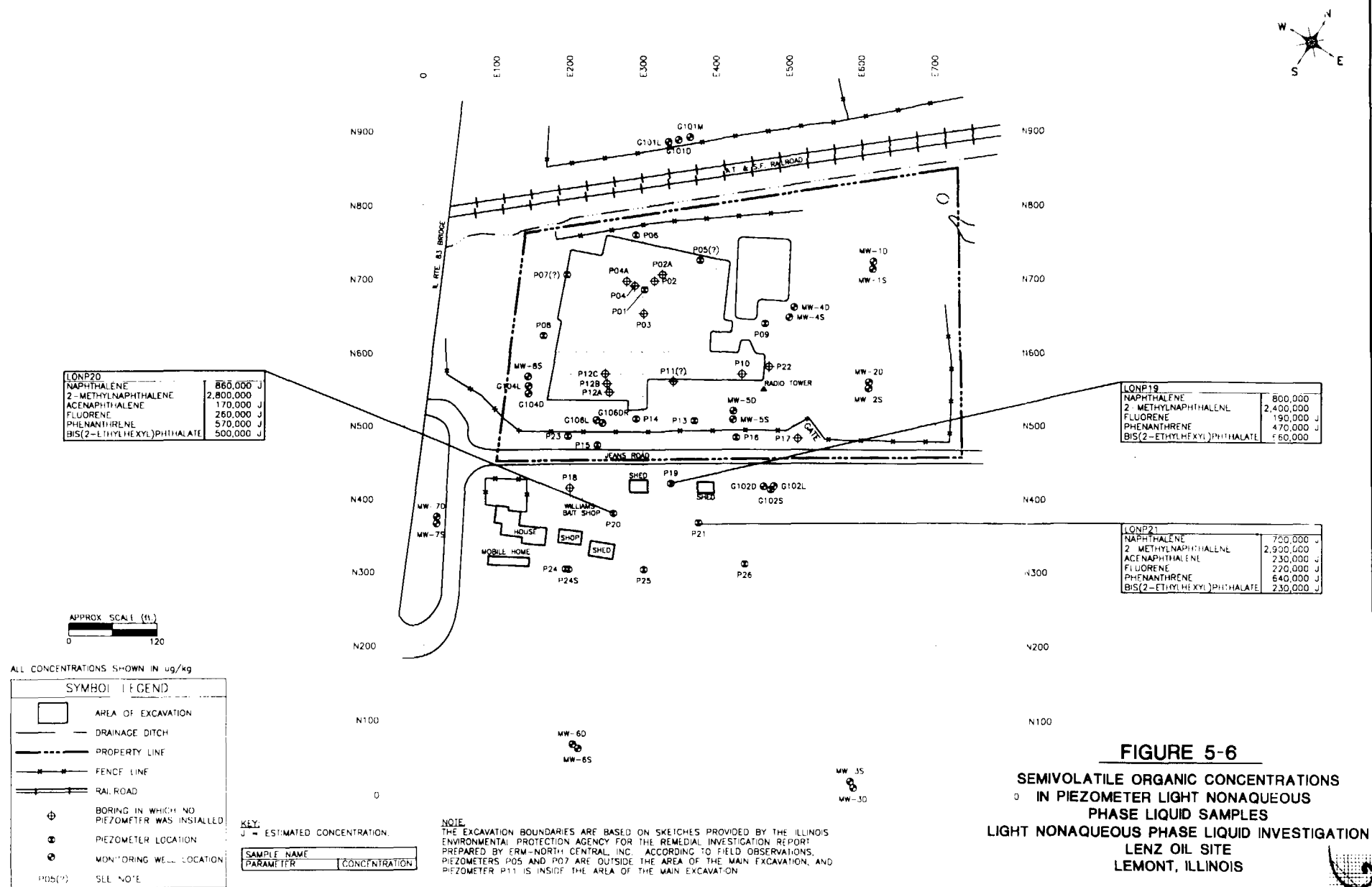
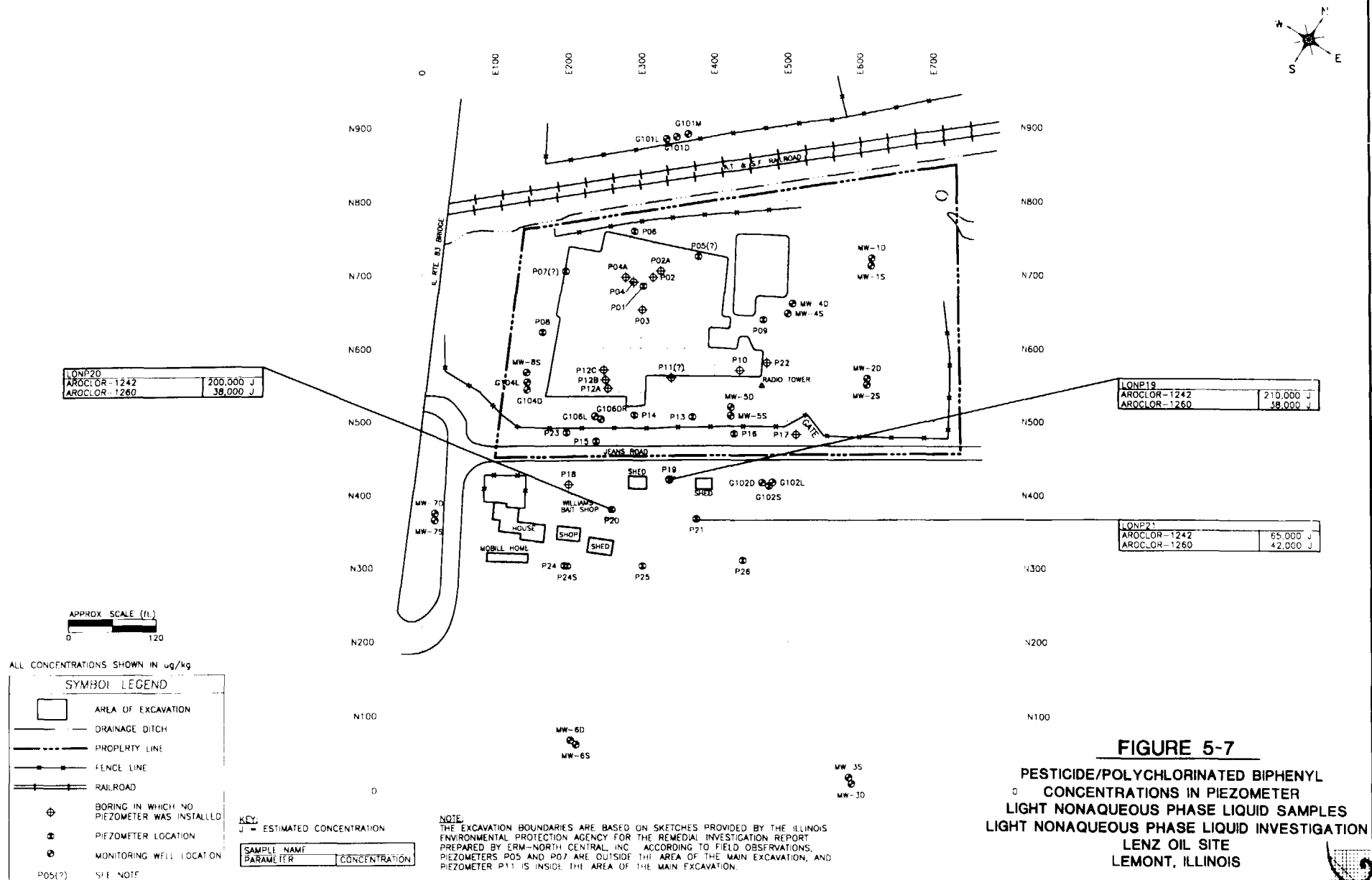


FIGURE 5-5
VOLATILE ORGANIC CONCENTRATIONS
IN PIEZOMETER LIGHT NONAQUEOUS
PHASE LIQUID SAMPLES
LIGHT NONAQUEOUS PHASE LIQUID INVESTIGATION
LENZ OIL SITE
LEMONT, ILLINOIS





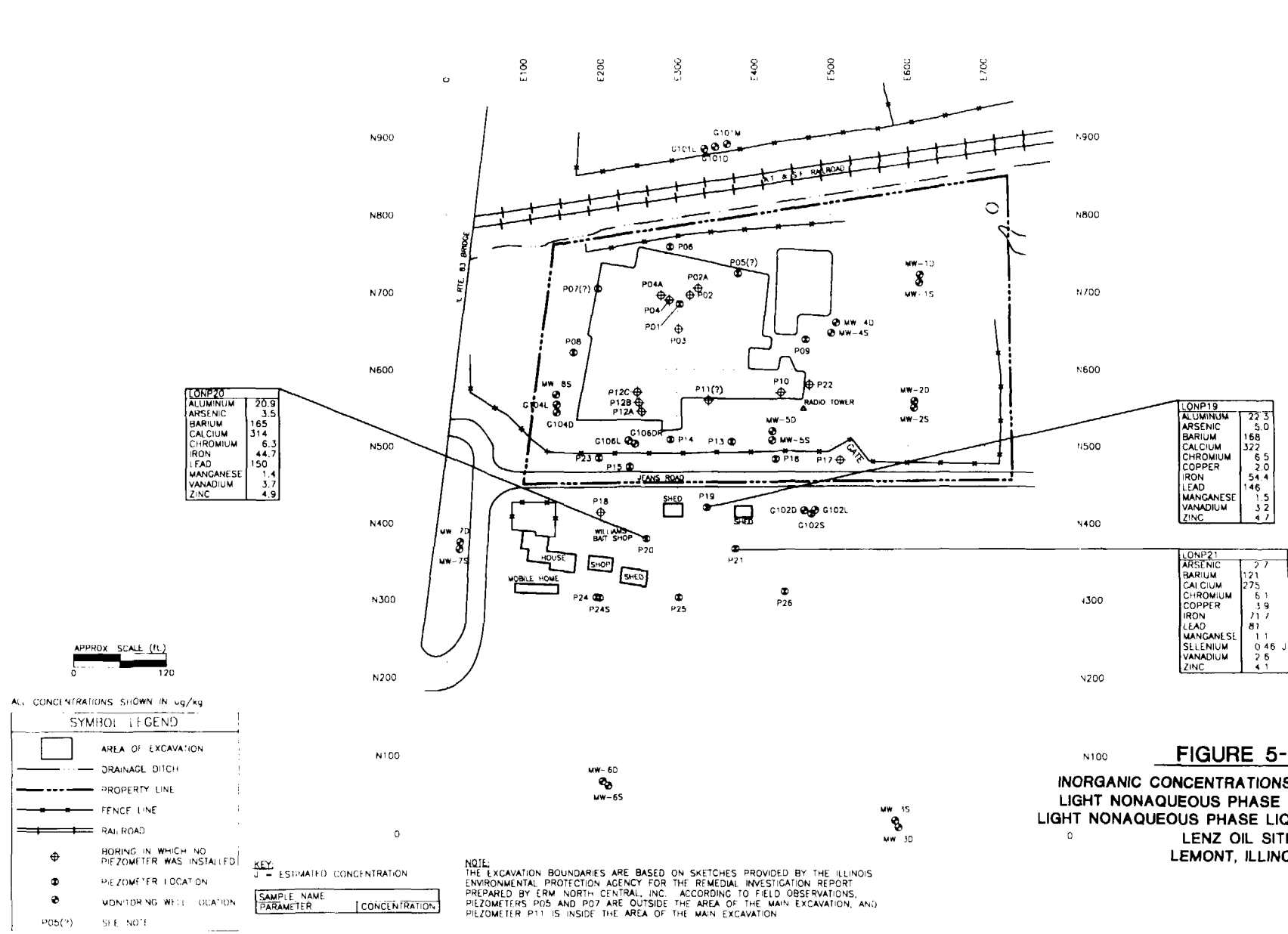


FIGURE 5-8
INORGANIC CONCENTRATIONS IN PIEZOMETER
LIGHT NONAQUEOUS PHASE LIQUID SAMPLES
LIGHT NONAQUEOUS PHASE LIQUID INVESTIGATION
LENZ OIL SITE
LEMONT, ILLINOIS

APPENIDX A
SOIL BORING LOGS

ERM-North Central, Inc.

Environmental Resources Management

GEOLOGIC DRILL LOG						PROJECT/TASK LNAPL INVESTIGATION		PROJECT NUMBER 9-017EM		SHEET NO. 1 of 2		HOLE NUMBER P-01			
SITE LENZ OIL				COORDINATES N 685.067; E303.207				CONTAMINANT SCREENING NOTES *HNU w/11.7 eV Probe **Headspace Sample							
BEGUN 8-2-94		COMPLETED 8-2-94		DRILLER Rock & So.				DRILLING EQUIPMENT Acker Soil Max. 4-1/4 I.D. HSA				BORING DIA. 8		DEPTH (FT) 17'	
CORE RECOVERY (FT./%) /				CORE BOXES		SAMPLES 7		ELEV. TOP CASING 603.03		GROUND ELEV. 600.3		DEPTH/ELEV. GROUND WATER 9.45' bgs / 590.85 AMSL		DEPTH/ELEV. TOP OF ROCK 15' bgs / 585.3 AMSL	
SAMPLE DEVICE 2"x3" Split Spoon/300 lb. hammer						DRILL CASING LEFT IN HOLE: DIA./LENGTH						LOGGED BY Dan Petersen			
SAMPLES/R.CORE				CONTAMINANT SCREENING			LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.			
Lab Sample # Time	Recovery (feet)	Length (feet)	Blow Count RQD (%)	Sample Scan** (Vppm)	Headspace** (Vppm)	Observations									
A	16	2.0	13		100	petro odor	-7-				0.0-0.7' TOPSOIL dark gray to brown roots				
							-2-				0.7-2.0' CLAY dark gray, gravelly pebbles, plastic, moist.				
B	15	2.0	9 9 10		42	petro odor, oil stained					2.0-7.0' SILTY CLAY olive brown to gray, pebbly, roots, semi-plastic, moist, concrete in split spoon tip				
C	15	2.0	2 3 3 4		50	oil stained		5			Abundant roots.				
D	1.75	2.0	5 8 9 9		256	oil stained	-7-				7.0-'5.0' CLAYEY SILT TO SILTY CLAY medium dark gray, organic, wood, peat, moist.				
E	1.2	2.0	2 5 9 12		238										
F	1.5	2.0	2 3 5 9		13		10				Saturated at 10', gravel and cobbles in split spoon tip.				
												No samples from 12-'5' bgs, refer to boring log G'05 for geologic data.			
								15							

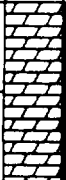


ERM-North Central, Inc.

Environmental Resources Management

GEOLOGIC DRILL LOG			PROJECT/TASK UNAPL INVESTIGATION		PROJECT NUMBER 94017EM	SHEET NO. 2 of 2	HOLE NUMBER P-01
SITE LEND OIL			COORDINATES N. 685.067; E303.207		CONTAMINANT SCREENING NOTES +H2O w/ 1/4" ev. Probe ---headspace Sample		
BEGUN 8-2-94	COMPLETED 8-2-94	DRILLER Rock & Soil		DRILLING EQUIPMENT Acker Soil Max. 4-1/4 I.D. HSA		BORING DIA. 8"	DEPTH (FT) 17'

Continued

SAMPLES/R.CORE				CONTAMINANT SCREENING			LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
Lab Sample #	Recovery (feet)	Length (feet)	Blow Count ROD (%)	Sample Scan** (Vppm)	Headspace** (Vppm)	Observations						
6	10	10	100		4			15			weathered bedrock at 15 feet	
								17			End of boring at 17 feet	
								20				
								25				
								30				



ERM-North Central, Inc.

Environmental Resources Management

GEOLOGIC DRILL LOG				PROJECT/TASK LAPL INVESTIGATION		PROJECT NUMBER 94017EM		SHEET NO. 1 of 1		HOLE NUMBER P-02		
SITE LEND OIL				COORDINATES		CONTAMINANT SCREENING NOTES *HNU with Lev Probe **Headspace Sample						
BEGUN 8-2-94		COMPLETED 8-2-94		DRILLER Rock & Soil		DRILLING EQUIPMENT Acker Soil Max. 4-1/4" I.D. HSA				BORING DIA. 8		
CORE RECOVERY (FT./%) 7		CORE BOXES 3		SAMPLES 3		ELEV. TOP CASING		GROUND ELEV. 7		DEPTH/ELEV. GROUND WATER NOT ENCOUNTERED		
DEPTH/ELEV. TOP OF ROCK NOT ENCOUNTERED		SAMPLE DEVICE 2'x3" Split Spoon/300 lb. hammer		DRILL CASING LEFT IN HOLE: DIA./LENGTH				LOGGED BY Dan Petersen				
SAMPLES/R.CORE				CONTAMINANT SCREENING			LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
Lab Sample # Time	Recovery (feet)	Length (feet)	Blow Count RQD (%)	Sample Scan* (Vppm)	Headspace** (Vppm)	Observations						
A	1.25	2.0	10.5 10.5		2						0.0-2.0 TOPSOIL, dark gray to black pebbles, trace of ash at 2', moist no odor.	
B	1.75	2.0	8 23 25 28		2						2.0-6.0 FEET ASH, black, trace gravel, dry, 40% clay, 30% sand, 20% gravel, 10% pebbles, liner encountered at 5.5' bgs	
C		2.0	9 10 10		18	odor						
											End of boring at 6 feet	

GEOLOGIC DRILL LOG

PROJECT/TASK	NAF INVESTIGATION
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PROJECT NUMBER
240754

SHEET NO.

HOLE NUMBER
P-03

SITE
LENZ OIL

COORDINATES
N. 652.555; E 302.307

CONTAMINANT SCREENING NOTES
*HNU w/11.7 eV Probe **Headspace Sample

BEGUN
B-10-94

COMPLETED
8-10-94

DRILLER
RICHARDSON

DRILLING EQUIPMENT
Acker So. Max. 4-1/4 I.D. - SA

BORING DIA.	
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DEPTH (FT)	2'
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1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466
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CORE BOXES	
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SAMPLES
4

ELEV. TOP CASING					
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GROUND ELEV.
600.55'

DEPTH/ELEV. GROUND WATER	
1	10.0
2	10.0
3	10.0
4	10.0
5	10.0
6	10.0
7	10.0
8	10.0
9	10.0
10	10.0
11	10.0
12	10.0
13	10.0
14	10.0
15	10.0
16	10.0
17	10.0
18	10.0
19	10.0
20	10.0
21	10.0
22	10.0
23	10.0
24	10.0
25	10.0
26	10.0
27	10.0
28	10.0
29	10.0
30	10.0
31	10.0
32	10.0
33	10.0
34	10.0
35	10.0
36	10.0
37	10.0
38	10.0
39	10.0
40	10.0
41	10.0
42	10.0
43	10.0
44	10.0
45	10.0
46	10.0
47	10.0
48	10.0
49	10.0
50	10.0
51	10.0
52	10.0
53	10.0
54	10.0
55	10.0
56	10.0
57	10.0
58	10.0
59	10.0
60	10.0
61	10.0
62	10.0
63	10.0
64	10.0
65	10.0
66	10.0
67	10.0
68	10.0
69	10.0
70	10.0
71	10.0
72	10.0
73	10.0
74	10.0
75	10.0
76	10.0
77	10.0
78	10.0
79	10.0
80	10.0
81	10.0
82	10.0
83	10.0
84	10.0
85	10.0
86	10.0
87	10.0
88	10.0
89	10.0
90	10.0
91	10.0
92	10.0
93	10.0
94	10.0
95	10.0
96	10.0
97	10.0
98	10.0
99	10.0
100	10.0

DEPTH/ELEV. TOP OF ROCK	NOT ENCOUNTERED
-------------------------	-----------------

SAMPLE DEVICE

2'x3' Split Spoon/300 lb. hammer

DRILL CASING LEFT IN HOLE: DIA./LENGTH	
1	1.500/10.000
2	1.500/10.000
3	1.500/10.000
4	1.500/10.000
5	1.500/10.000
6	1.500/10.000
7	1.500/10.000
8	1.500/10.000
9	1.500/10.000
10	1.500/10.000
11	1.500/10.000
12	1.500/10.000
13	1.500/10.000
14	1.500/10.000
15	1.500/10.000
16	1.500/10.000
17	1.500/10.000
18	1.500/10.000
19	1.500/10.000
20	1.500/10.000
21	1.500/10.000
22	1.500/10.000
23	1.500/10.000
24	1.500/10.000
25	1.500/10.000
26	1.500/10.000
27	1.500/10.000
28	1.500/10.000
29	1.500/10.000
30	1.500/10.000
31	1.500/10.000
32	1.500/10.000
33	1.500/10.000
34	1.500/10.000
35	1.500/10.000
36	1.500/10.000
37	1.500/10.000
38	1.500/10.000
39	1.500/10.000
40	1.500/10.000
41	1.500/10.000
42	1.500/10.000
43	1.500/10.000
44	1.500/10.000
45	1.500/10.000
46	1.500/10.000
47	1.500/10.000
48	1.500/10.000
49	1.500/10.000
50	1.500/10.000
51	1.500/10.000
52	1.500/10.000
53	1.500/10.000
54	1.500/10.000
55	1.500/10.000
56	1.500/10.000
57	1.500/10.000
58	1.500/10.000
59	1.500/10.000
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62	1.500/10.000
63	1.500/10.000
64	1.500/10.000
65	1.500/10.000
66	1.500/10.000
67	1.500/10.000
68	1.500/10.000
69	1.500/10.000
70	1.500/10.000
71	1.500/10.000
72	1.500/10.000
73	1.500/10.000
74	1.500/10.000
75	1.500/10.000
76	1.500/10.000
77	1.500/10.000
78	1.500/10.000
79	1.500/10.000
80	1.500/10.000
81	1.500/10.000
82	1.500/10.000
83	1.500/10.000
84	1.500/10.000
85	1.500/10.000
86	1.500/10.000
87	1.500/10.000
88	1.500/10.000
89	1.500/10.000
90	1.500/10.000
91	1.500/10.000
92	1.500/10.000
93	1.500/10.000
94	1.500/10.000
95	1.500/10.000
96	1.500/10.000
97	1.500/10.000
98	1.500/10.000
99	1.500/10.000
100	1.500/10.000

LOGGED BY	
-----------	--

Russ Petersen

SAMPLES/R.CORE

CONTAMINANT SCREENING

Lab Sample #

Recovery

Length

Blow Count

ample Scan*

eadspace**

ENIN	
------	--

ations

LAYER

SAMPLE	GRAVIMIC LOG
--------	--------------

DESCRIPTION AND CLASSIFICATION
density, grain size/shape, color, structure
composition, sorting, texture, moisture
facies, odor

DRILLING NOTES
water levels,
water return,
character of drilling,
etc.

0.0-0.0' TOPSOIL

10-8.0' FL. AS - brownish black,
pebbly, silty, clayey dry

Initial B-03 location was not drilled because of the shallow depth of water. The boring was moved to the "A" location noted on the survey.

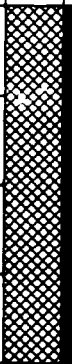
End of boring at 8 feet:



ERM-North Central, Inc.

Environmental Resources Management

GEOLOGIC DRILL LOG										PROJECT/TASK LNAPL INVESTIGATION		PROJECT NUMBER 9407EM		SHEET NO. 1 of 1		HOLE NUMBER P-04	
SITE LEND OIL				COORDINATES N 690.365; E 289.970				CONTAMINANT SCREENING NOTES +HND with 7' e. Probe ++headspace Sample									
BEGUN 8-2-94		COMPLETED 8-2-94		DRILLER Rock & Soil				DRILLING EQUIPMENT Acker Soil Max. 4-1/4" I.D. HSA				BORING DIA. 8"		DEPTH (FT) 4'			
CORE RECOVERY (FT./%) /				CORE BOXES 2		SAMPLES 2		ELEV. TOP CASING 600.127		DEPTH/ELEV. GROUND WATER NOT ENCOUNTERED				DEPTH/ELEV. TOP OF ROCK NOT ENCOUNTERED			
SAMPLE DEVICE 2'x3' Split Spoon/300 p. hammer				DRILL CASING LEFT IN HOLE: DIA./LENGTH						LOGGED BY Dan Petersen							
SAMPLES/R.CORE				CONTAMINANT SCREENING			LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.					
Lab Sample # Time	Recovery (feet)	Length (feet)	Blow Count RGD (%)	Sample Scan* (Vppm)	Headspace** (Vppm)	Observations											
A	1.8	2.0	100%		10						0.0-0.5' TOPSOIL black pebbly	Visqueen liner at 2' bgs					
											0.5-4.0' FILLASH black to brownish black, abundant topsoil.						
B	1.0	2.0	100%		110	petro odor & stain					Silty, cobbles, moderate yellowish brown						
											End of boring at 4 feet.						

GEOLOGIC DRILL LOG						PROJECT/TASK UNAPL INVESTIGATION		PROJECT NUMBER 94017EM		SHEET NO. 1 of 1		HOLE NUMBER P-04A		
SITE LEND OIL				COORDINATES N. 896.843; E. 278.843				CONTAMINANT SCREENING NOTES *-Flow w/11.7' ev Probe **Headspace Sample						
BEGUN 8-10-94		COMPLETED 8-10-94		DRILLER Rock & Soil			DRILLING EQUIPMENT Acker Soil Max. 4-1/4" I.D. HSA				BORING DIA. 8"		DEPTH (FT) 4'	
CORE RECOVERY (FT./%) /			CORE BOXES		SAMPLES 2	ELEV. TOP CASING	GROUND ELEV. 599.813	DEPTH/ELEV. GROUND WATER			DEPTH/ELEV. TOP OF ROCK NOT ENCOUNTERED			
SAMPLE DEVICE 2"x3" Split Spoon/300 lb. hammer						DRILL CASING LEFT IN HOLE: DIA./LENGTH					LOGGED BY Russ Petersen			
SAMPLES/R.CORE				CONTAMINANT SCREENING			LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.		
Lab Sample # Time	Recovery (feet)	Length (feet)	Blow Count ROD (%)	Sample Scan** (Vppm)	Headspace** (Vppm)	Observations								
A		2.0	6.0		50	odor					0.0-4.0' FILLASH - brownish black pebbly dry			
B		2.0	6.0		120							Hit liner at 3.0 feet.		
											End of boring at 4 feet.			



GEOLOGIC DRILL LOG				PROJECT/TASK LAPD INVESTIGATION		PROJECT NUMBER 94017EM		SHEET NO. 1 of 1		HOLE NUMBER P-05		
SITE LEND OIL				COORDINATES N 722,170; E 393,308		CONTAMINANT SCREENING NOTES +H2O W 11.7 e, Probs +H3BO3 Probs Same						
BEGUN 8-5-94		COMPLETED 8-5-94		DRILLER Rock & Soil		DRILLING EQUIPMENT Acker Soil Max. 4-1/4 I.D. HSA				BORING DIA. 8"		
CORE RECOVERY (FT./%) /		CORE BOXES		SAMPLES 6		ELEV. TOP CASING 602.84		GROUND ELEV. 600.1		DEPTH/ELEV. GROUND WATER 10' bgs / 590.10 AMSL		
SAMPLE DEVICE 2x3 Split Spoon 300 lb. hammer				DRILL CASING LEFT IN HOLE: DIA./LENGTH				LOGGED BY Dan Petersen				
SAMPLES/R.CORE				CONTAMINANT SCREENING			LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
Lab Sample # Time	Recovery (feet)	Length (feet)	Blow Count RQD (%)	Sample Scan* (Vppm)	Headspace** (Vppm)	Observations						
A	2.0	2.0	100		0.5						0.0-4.0' TOPSOIL, brownish black, silty, abundant peat, roots, trace pebbles, trace cinders, moist.	
B	2.0	2.0	100		0.6						Fewer roots.	
C	2.0	2.0	100			no odor	-4-				4.0-10.0' SILTY CLAY, dark gray to brownish black, pebbles, soft, moist.	
D	0.5	2.0	100		5		5					
E	0.5	2.0	100		2							
F	2.0	2.0	100		0.2		-10-				10.0-12.0' CLAYEY SILT, dark greenish gray, shales abundant, roots, contact at 10.2', saturated, dark greenish gray and dusky yellow banded dolomite at 12.0'	
							-12-				End of boring at 12 feet.	
							15					



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Environmental Resources Management

GEOLOGIC DRILL LOG				PROJECT/TASK LNAPL INVESTIGATION		PROJECT NUMBER 94017EM		SHEET NO. 1 of 1		HOLE NUMBER P-06		
SITE LENZ OIL				COORDINATES N 759.238; E 291.570		CONTAMINANT SCREENING NOTES *HND w/11.7 ev Probe **Headspace Sample						
BEGUN 8-2-94		COMPLETED 8-2-94		DRILLER Rock & Soil		DRILLING EQUIPMENT Acker Soil Max. 4-1/4" I.D. HSA				BORING DIA. 8"		
CORE RECOVERY (FT./%) /		CORE BOXES		SAMPLES 5		ELEV. TOP CASING 603.83		GROUND ELEV. 600.7		DEPTH/ELEV. GROUND WATER 2' bgs / 592.70AMS		
DEPTH/ELEV. TOP OF ROCK 7.5' bgs / 593.2AMS		SAMPLE DEVICE 2'x3' Split Spoon/300 lb. hammer				DRILL CASING LEFT IN HOLE: DIA./LENGTH				LOGGED BY Dan Petersen		
SAMPLES/R.CORE				CONTAMINANT SCREENING			LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
Lab Sample # Time	Recovery (feet)	Length (feet)	Blow Count RCD (%)	Sample Scan* (Vppm)	Headspace** (Vppm)	Observations						
A	2.0	2.0	100		18						0.0-1.0' TOPSOIL black, roots moist	
											1.0-1.5' CINDERS black, trace grave dry.	
B	0.0	2.0	0								1.5-7.5' SILTY CLAY brownish gray trace pebbles, roots, gass, oxidized.	
C	1.5	2.0	123		30	stained					Moderate yellowish brown, pebbly.	
D	1.8	2.0	612620		12							
E	1.0	1.0	2750/5		5						7.5-9.0' DOLOMITE weathered saturated.	
											End of boring at 9 feet.	



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Environmental Resources Management

GEOLOGIC DRILL LOG										PROJECT/TASK LNAPL INVESTIGATION		PROJECT NUMBER 94017EM		SHEET NO. 1 of 1		HOLE NUMBER P-07	
SITE LEND OIL					COORDINATES N 705.466; E 97.089					CONTAMINANT SCREENING NOTES +HNU W/MT. 7' 10" Probe ++Headspace Sample							
BEGUN 8-5-94		COMPLETED 8-5-94		DRILLER Rock & Soil			DRILLING EQUIPMENT Acker Soil Max. 4-1/4 I.D. HSA					BORING DIA. 8		DEPTH (FT) 14'			
CORE RECOVERY (FT./%) /			CORE BOXES		SAMPLES 7		ELEV. TOP CASING 600.55		GROUND ELEV. 598.8		DEPTH/ELEV. GROUND WATER 7.04' bgs; 597.6 AMSL			DEPTH/ELEV. TOP OF ROCK NOT ENCOUNTERED			
SAMPLE DEVICE 2'x3' Split Spoon/300 lb. hammer							DRILL CASING LEFT IN HOLE: DIA./LENGTH					LOGGED BY Dan Petersen					
SAMPLES/R.CORE				CONTAMINANT SCREENING			LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.					
Lab Sample # Time	Recovery (feet)	Length (feet)	Blow Count RQD (%)	Sample Scan* (Vppm)	Headspace** (Vppm)	Observations											
A	2.0	2.0	100		0.8						0.0-4.0' TOPSOIL, black, silty, pebbly, sandy, rootlets, plastic moist						
B	0.3	2.0	25		0.8						Some cobbles.						
C	0.5	2.0	18		1.2		-4				4.0-6.0' FILL Concrete debris and rubble						
D	1.0	2.0	1		1.5		-6				6.0-8.0' SILTY CLAY, black, moist to saturated at 8.0'						
E	2.0	2.0	1		1.2		-8				8.0-10.0' CLAYEY SILT, dark greenish gray, abundant shells, plastic wet.						
F	1.5	2.0	1		0.8		-10	10			10.0-14.0' GRAVEL, light gray, sandy, very coarse grained, saturated.						
G	2.0	2.0	1		0.8		-12										
							-14				End of boring at 14 feet						
							15										



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GEOLOGIC DRILL LOG				PROJECT/TASK ENAPL INVESTIGATION		PROJECT NUMBER 9407EM		SHEET NO. 1 of 1		HOLE NUMBER P-08		
SITE LEWIS OIL				COORDINATES N. 622.815; E 165.867		CONTAMINANT SCREENING NOTES +HNU W/11.7' EV Probe +Headscap Sample						
BEGUN 8-5-94		COMPLETED 8-5-94		DRILLER Rock & Soil		DRILLING EQUIPMENT Acker Soil Max. 4-1/4 I.D. HSA				BORING DIA. 8"		
CORE RECOVERY (FT./%) /		CORE BOXES 6		SAMPLES 6		ELEV. TOP CASING 600.8'		GROUND ELEV. 598.8		DEPTH/ELEV. GROUND WATER 7' logs / 591.80 AMSL		
SAMPLE DEVICE 2'x3" Soil Spoon/300 lb. hammer				DRILL CASING LEFT IN HOLE: DIA./LENGTH				LOGGED BY Dan Petersen				
SAMPLES/R.CORE				CONTAMINANT SCREENING			LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
Lab Sample # Time	Recovery (feet)	Length (feet)	Blow Count RQD (%)	Sample Scan** (Vppm)	Headspace** (Vppm)	Observations						
A	1.2	2.0	5		0.0						0.0-3.0' TOPSOIL: black, roots, wood fragments, loose, moist.	
B	1.0	2.0	27		15		-3				3.0-4.0' FILL: Concrete chips.	
C	1.5	2.0	16 32 44		15		-4				4.0-10.5' GRAVEL: light gray, sandy, trace clay, loose, moist.	
D	1.2	2.0	13 12 11 13		80	stain & odor	5				Saturated at 7.0 feet.	
E	1.0	2.0	26 50/5		70		10					
F	0.5	0.5	50/2		20		-10.5				Auger refusal at 10.5 feet.	
							15				End of boring at 10.5 feet.	

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GEOLOGIC DRILL LOG				PROJECT/TASK LAPL INVESTIGATION		PROJECT NUMBER 9407EM		SHEET NO. 1 of 1		HOLE NUMBER P-09	
SITE LEND OIL				COORDINATES N 641 197; E 468 1274		CONTAMINANT SCREENING NOTES --NU W/MLT ex Probe --Headspace Sample					
BEGUN 8-1-94		COMPLETED 8-1-94		DRILLER Rock & Soil		DRILLING EQUIPMENT Acker Soil Max. 4-1/4 I.D. HSA				BORING DIA. 8"	
DEPTH (FT) 15'		CORE RECOVERY (FT./%) /		CORE BOXES 8		SAMPLES 803.62		ELEV. TOP CASING 600.8		GROUND ELEV. 600.8	
DEPTH/ELEV. GROUND WATER 10.40 bgs / 590.40 AMSL		DEPTH/ELEV. TOP OF ROCK 15' bgs / 585.3 AMSL		SAMPLE DEVICE 2'x3" Split Spoon / 40 lb. hammer				DRILL CASING LEFT IN HOLE: DIA./LENGTH			
LOGGED BY Russ Pedersen											
SAMPLES/R.CORE		CONTAMINANT SCREENING			LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.	
Lab Sample # Time	Recovery (feet)	Length (feet)	Blow Count ROD (%)	Sample Scan** (Vppm)							Headspace** (Vppm)
A 14.30	2.0	2.0	50/5		0.2				0.0-2.0' <u>CLAY</u> , brownish black, silty pebbly, under ash, dry.		
B 14.40	1.0	2.0	50/5		18	strong odor			2.0-12.0' <u>CLAY</u> , gray silty sandy angular dolomite gravel, wood.		
C	0.0	2.0	50/5								
D 14.50	0.0	2.0	50/5		0.6	odor			Not silty trace wood, most.		
E	1.8	2.0	50/3		0.8						
F	0.25	2.0	50/0		4				Silty saturated at 10.		
G	0.0	2.0	50/0								
H	0.0	1.0	50/0						12.0-15.0' <u>CLAYEY GRAVEL</u> , gray saturated.		
I	0.0	1.0	50/0								

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GEOLOGIC DRILL LOG				PROJECT/TASK LAPL INVESTIGATION		PROJECT NUMBER 9407EM	SHEET NO. 01	HOLE NUMBER P-11				
SITE LENZ OIL			COORDINATES N 559.651 E 342.048		CONTAMINANT SCREENING NOTES *HNU w/11.7 ev Probe **Headspace Sample							
BEGUN 8-10-94	COMPLETED 8-10-94	DRILLER Rock & Soil		DRILLING EQUIPMENT Acker Sol. Max. 4-1/4" I.D. - SA			BORING DIA. 8	DEPTH (FT) 7.5'				
CORE RECOVERY (FT.%) /		CORE BOXES	SAMPLES 4	ELEV. TOP CASING	GROUND ELEV. 601.627	DEPTH/ELEV. GROUND WATER		DEPTH/ELEV. TOP OF ROCK NOT ENCOUNTERED				
SAMPLE DEVICE 2'x3" Sp. t. Spoon/400 lb. hammer			DRILL CASING LEFT IN HOLE: DIA./LENGTH				LOGGED BY Russ Petersen					
SAMPLES/R.CORE				CONTAMINANT SCREENING			LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
Lab Sample # Time	Recovery (feet)	Length (feet)	Blow Count RCD (%)	Sample Scan* (Vppm)	Headspace** (Vppm)	Observations						
A	0.0	0.0			0.0						0.0-0.5' TOPSOIL black	No recovery Concrete in split spoon
B	0.2	2.0	6 in 4.5		1.0						0.5-4.0' EL. gravel, light red to gray concrete, brittle dry	
C	1.0	2.0	5 5 7 50/0		2.0	odor					4.0-7.5' SANDY SILT: pale yellowish orange, large cobbles, stained, moist	
D	1.0	1.5	7 10 27		15.0	odor						
											End of boring at 7.5 feet	

GEOLOGIC DRILL LOG

PROJECT/TASK	NAP INVESTIGATION
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PROJECT NUMBER
0107EM

SHEET NO. 104

HOLE NUMBER	P-12
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SITE
LEZ OIL

COORDINATES
N 570.263; E248.785

CONTAMINANT SCREENING NOTES

BEGUN
8-10-94

COMPLETED
8-10-94

DRILLER
Rock & Soil

DRILLING EQUIPMENT
Acker Soil Max. 4-1/4" I.D. - 55A

BORING DIA.	
E	

DEPTH (FT)
9.5'

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466
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CORE BOXES	
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SAMPLES
5

	ELEV.TOP CASING
--	-----------------

GROUND ELEV.
600.686

DEPTH/ELEV. GROUND WATER

DEPTH/ELEV. TOP OF ROCK	NOT ENCOUNTERED
-------------------------	-----------------

SAMPLE DEVICE			
2'x3" Split Spoon/400 lb. hammer			

DRILL CASING LEFT IN HOLE: DIA./LENGTH	
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LOGGED BY
Russ Petersen

SAMPLES/R.CORE				CONTAMINANT SCREENING			LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
Lab Sample # Time	Recovery (feet)	Length (feet)	Blow Count RCD (%)	Sample Scan* (Vppm)	Headspace** (Vppm)	Obser- vations						
A	2.0	2.0	4.0			no odor		5		0.0-9.5' E... brown sh black, silty clayey, pebbly, dense, dry		
B	2.0	2.0			4.0							
C	2.0	2.0	3.5		3.5							
D	2.0	2.0	4.0		3.5							
E	0.5	1.5	4.0		4.0							
							10			Saturated at 9.0 to 9.5'.		
							15			End of boring at 9.5 feet.		



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Environmental Resources Management

GEOLOGIC DRILL LOG				PROJECT/TASK UNAPL INVESTIGATION		PROJECT NUMBER 94017EN	SHEET NO. 1 of 1	HOLE NUMBER P-13				
SITE LENZ OIL			COORDINATES N. 506.215; E371.047		CONTAMINANT SCREENING NOTES +Flow w/11.75" Ev Probe +--headscape Sample							
BEGUN 8-3-94	COMPLETED 8-3-94	DRILLER Rock & So	DRILLING EQUIPMENT Auger Sp. Max. 4-1/4 I.D. HSA			BORING DIA. 8	DEPTH (FT) 14.75'					
CORE RECOVERY (FT./%) /	CORE BOXES	SAMPLES 6	ELEV. TOP CASING 603.75	GROUND ELEV. 600.815	DEPTH/ELEV. GROUND WATER 8' 11.75' bgs / 588.07 AMSL	DEPTH/ELEV. TOP OF ROCK 14.75' bgs / 588' AMSL						
SAMPLE DEVICE 2'x3' Sp. & Spoon/300 lb. hammer			DRILL CASING LEFT IN HOLE: DIA./LENGTH			LOGGED BY Dan Petersen						
SAMPLES/R.CORE				CONTAMINANT SCREENING			LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
Lab Sample # Time	Recovery (feet)	Length (feet)	Blow Count RQD (%)	Sample Scan** (Vppm)	Headspace** (Vppm)	Observations						
A 12:30		2.0	43 50/5		0.2						0.0-2.0' FILL GRAVEL AND CONCRETE	
B 14:40		2.0	30 50/5		18	strong odor	-2				2.0-5.75' FILL, COARSE Angular cobbles of dolomite, saturated near base	
C	0.0	2.0	50/5				5					
D 14:50	0.0	2.0	17 4 4 6		0.6	odor	-5.7 -6				5.75-6.0' CONCRETE FLOOR 6.0-8.0' SILTY SAND AND GRAVEL pale olive, trace of clay, most dense.	
E		2.0	6 100		0.8		-8				8.0-10.0' CLAYEY SILT light gray, pebbly, moist	
F		2.0	Ref		4		-10	10			10.0-14.75' SANDY GRAVEL tan to gray, angular, oxidized, saturated at 11.75' bgs	
G	0.0	2.0	29 50			stained						
H		0.75					-14.75	15				

Auger refusal at 14.75 feet, drill cuttings and drilling character indicate bedrock at 14.75 feet

End of boring at 14.75 feet



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Environmental Resources Management

GEOLOGIC DRILL LOG				PROJECT/TASK LNAPL INVESTIGATION		PROJECT NUMBER 94017EM		SHEET NO. 1 of 1		HOLE NUMBER P-14		
SITE LENZ OIL				COORDINATES N 508.64; E 291.058		CONTAMINANT SCREENING NOTES *HNU W/11.7' Ev Probe **Headspace Sample						
BEGUN 8-3-94		COMPLETED 8-3-94		DRILLER Rock & Soil		DRILLING EQUIPMENT Acker Soil Max. 4-1/4 I.D. HSA				BORING DIA. 8"		
CORE RECOVERY (FT./%) /		CORE BOXES		SAMPLES 8		ELEV. TOP CASING 603.69		GROUND ELEV. 600.9		DEPTH/ELEV. GROUND WATER 12' bgs / 588.90 AMSL		
SAMPLE DEVICE 2"x2" Split Spoon/140 lb. hammer				DRILL CASING LEFT IN HOLE: DIA./LENGTH						LOGGED BY Dan Pedersen		
SAMPLES/R.CORE				CONTAMINANT SCREENING			LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
Lab Sample # Time	Recovery (feet)	Length (feet)	Blow Count RGD (%)	Sample Scan** (Vppm)	Headspace** (Vppm)	Observations						
A	1.0	2.0	2		2						0.0-1.0' TOPSOIL, black roots, moist	
											1.0-2.3' FILL, Clay brownish black, silty	
B	1.5	2.0			4						2.3-8.0' SANDY SILT, dark yellowish orange, light gray mottling, pebbly cobbles, metal debris, dry.	
C	1.5	1.5	4 29 30		8							
D	0.5	1.0	22 50		4							Cobbles in split spoon tip
E	1.25	2.0	17 21 30		10						8.0-14.0' SILTY SANDY GRAVEL, olive gray, well graded, angular, saturated at 12' bgs	Cobbles in split spoon tip.
F	0.0	0.5	17 50/0									Split spoon refusal.
G	0.25	0.5	25 50/0			stained						Split spoon refusal
H	0.0	0.0	80/0								14.0-15.0' COLOMITE, light gray, massive	



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GEOLOGIC DRILL LOG				PROJECT/TASK LNAPL INVESTIGATION		PROJECT NUMBER 9407EM		SHEET NO. 1 of 2		HOLE NUMBER P-15		
SITE LEND OIL				COORDINATES N 472.855; E 235.410		CONTAMINANT SCREENING NOTES +HND w/11.7' ev Probe +headspace Sample						
BEGUN 8-8-94		COMPLETED 8-8-94		DRILLER Rock & Soil		DRILLING EQUIPMENT 4-1/4 I.D. HSA/6" Water Rotary				BORING DIA. 8"		
CORE RECOVERY (FT.%) /		CORE BOXES		SAMPLES 6		ELEV. TOP CASING 601.34		GROUND ELEV. 601.654		DEPTH/ELEV. GROUND WATER 11.5' bgs / 590.654MSL		
SAMPLE DEVICE 2'x3" Split Spoon/300 lb. hammer				DRILL CASING LEFT IN HOLE: DIA./LENGTH				LOGGED BY Dan Petersen				
SAMPLES/R. CORE				CONTAMINANT SCREENING			LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
Lab Sample # Time	Recovery (feet)	Length (feet)	Blow Count R60 (%)	Sample Scan** (Vppm)	Headspace** (Vppm)	Observations						
A	15	2.0	14 18 17 25		0.0						0.0-2.0' FILL: Gravel, brownish black sandy, silty road base, dry	Drill with HSA above bedrock.
B	2.0	2.0	12 18 17 25		0.2						2.0-8.0' CLAYEY SILT: pale yellowish orange, mottled, light olive gray, pebbly, 10% angular dolomite gravel, some oxidation, moist.	
C	2.0	2.0	14 18 17 25		0.0						Cobbles, 20% gravel.	
D	0.5	1.25	7 17 25/3		0.8							
E		2.0	15 38 22 37		0.6						8.0-11.5' GRAVELLY SILTY CLAY, light olive gray, abundant angular dolomite cobbles, saturated at 10'	
F		1.5	16 17 50/6								Saturated zones in gravel rich intervals.	Auger refusal at 11.5 feet.
											11.5-20.0' DOLOMITE	



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Environmental Resources Management

GEOLOGIC DRILL LOG

PROJECT/TASK

LNAPL INVESTIGATION

PROJECT NUMBER

9401TEM

SHEET NO.

2 of 2

HOLE NUMBER

P-15

SITE

LENZ OIL

COORDINATES

N 472,855; E 238,410

CONTAMINANT SCREENING NOTES

+H₂O w/11.7 ev Probe ++Headspace Sample

BEGUN

8-8-94

COMPLETED

8-8-94

DRILLER

Rock & Soil

DRILLING EQUIPMENT

4-1/4 I.D. HSA/6" Water Rotary

BORING DIA.

8"

DEPTH (FT)

20'

Continued

SAMPLES/R.CORE				CONTAMINANT SCREENING			LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
Lab Sample #	Recovery (feet)	Length (feet)	Blow Count RQD (%)	Sample Scan* (Vppm)	Headspace** (Vppm)	Observations						
								15				
								-20-20			End of boring at 20 feet.	
								25				
								30				



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Environmental Resources Management

GEOLOGIC DRILL LOG										PROJECT/TASK LNAPL INVESTIGATION		PROJECT NUMBER 94017EM		SHEET NO. 1 of 2		HOLE NUMBER P-16	
SITE LENI OIL				COORDINATES N. 484,328; E 428,683				CONTAMINANT SCREENING NOTES +H ₂ O w/1.7% Ev Prope +H ₂ O Headspace Sample									
BEGUN 8-8-94		COMPLETED 8-8-94		DRILLER Rock & Soil		DRILLING EQUIPMENT 4-1/4" ID HSA / 6" Water Rotary				BORING DIA. 8"		DEPTH (FT) 2"					
CORE RECOVERY (FT./%) /		CORE BOXES		SAMPLES 6		ELEV. TOP CASING 604.20		GROUND ELEV. 601.7		DEPTH/ELEV. GROUND WATER 12.4" bgs / 589.28 AMSL		DEPTH/ELEV. TOP OF ROCK 11.5" bgs / 590.2 AMSL					
SAMPLE DEVICE 2"x3" Split Spoon/300 b. hammer				DRILL CASING LEFT IN HOLE: DIA./LENGTH						LOGGED BY Russ Pedersen							
SAMPLES/R.CORE				CONTAMINANT SCREENING			LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.					
Lab Sample # Time	Recovery (feet)	Length (feet)	Blow Count RQD (%)	Sample Scan* (Vppm)	Headspace** (Vppm)	Observations											
A	2.0	2.0	100/100		0.2						0.0-3.0' SAND AND GRAVEL, pale yellow orange, large cobbles.	No recovery.					
B	0.0	2.0	80/73								3.0-8.0' CLAYEY SILT, pale yellowish orange, pebbly, oxidized, loose, moist/dry.						
C	0.5	2.0	50/5		0.4						Very moist.	Saturated auger cuttings					
D	1.0	2.0			0.6						8.0-11.5' CLAYEY SILT, light gray, pebbly, dolomite cobbles, moist.						
E	2.0	2.0	15 18 20 25		0.6												
F	0.5	1.5	2 50/5		0.8							Auger refusal at 11.5 feet					
											11.5-21.0' DOLOMITE						



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GEOLOGIC DRILL LOG				PROJECT/TASK LNAPL INVESTIGATION		PROJECT NUMBER 94017EM	SHEET NO. 2 of 2	HOLE NUMBER P-16				
SITE LEND OIL			COORDINATES N. 484.328; E 428.583		CONTAMINANT SCREENING NOTES +H ₂ O w/ 11.7 mv Probe **Headspace Sample							
BEGUN 8-8-94	COMPLETED 8-8-94	DRILLER Rock & Soil	DRILLING EQUIPMENT 4-1/4" ID HSA / 6" Water Rotary			BORING DIA. 8"	DEPTH (FT) 21'					
<i>Continued</i>												
SAMPLES/R.CORE				CONTAMINANT SCREENING			LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
Lab Sample # Time	Recovery (feet)	Length (feet)	Blow Count RCD (%)	Sample Scan* (Vppm)	Headspace** (Vppm)	Observations						
								15				
								20				
								21				
											End of boring at 21 feet.	
								25				
								30				



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GEOLOGIC DRILL LOG				PROJECT/TASK LNAPL INVESTIGATION		PROJECT NUMBER 94017EM		SHEET NO. 1 of 1		HOLE NUMBER P-17		
SITE LEND OIL				COORDINATES N 482.013; E 511.004		CONTAMINANT SCREENING NOTES ***NO w/MLT EV Probe*** Headspace Sample						
BEGUN 8-1-94		COMPLETED 8-1-94		DRILLER Rock & Soil		DRILLING EQUIPMENT Ackert Soil Max. 4-1/4" I.D. HSA				BORING DIA. 8"		
CORE RECOVERY (FT./%) /		CORE BOXES 5		SAMPLES 5		ELEV. TOP CASING 601.868		DEPTH/ELEV. GROUND WATER		DEPTH/ELEV. TOP OF ROCK 8.2' bgs / 593 TMSL		
SAMPLE DEVICE 2'x3" Split Spoon/300 lb. hammer				DRILL CASING LEFT IN HOLE: DIA./LENGTH				LOGGED BY Dan Petersen				
SAMPLES/R.CORE				CONTAMINANT SCREENING			LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
Lab Sample # Time	Recovery (feet)	Length (feet)	Blow Count RQD (%)	Sample Scan* (Vppm)	Headspace** (Vppm)	Observations						
A 9.35		2.0	60/100		0.2						0.0-2.0' FILL SAND AND GRAVEL, light olive gray to moderate yellowish brown sand, gravel, and cobbles, dry	
B 9.45		2.0	74/100		0.2						2.0-8.2' SAND, pale yellowish orange, very fine grained, dry	
C 9.50		2.0	50/15		0.6						Cobbles.	
D		2.0	75/8		0.6						Moist	
E		2.2	6/2								End of boring at 8.2 feet	Dolomite in split spoon tip.

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GEOLOGIC DRILL LOG				PROJECT/TASK		PROJECT NUMBER	SHEET NO.	HOLE NUMBER					
LENZ OIL				ENVIRONMENTAL INVESTIGATION		840175V	212	P-19					
SITE			COORDINATES		CONTAMINANT SCREENING NOTES								
8-9-94			N. 420.042; E339.054		--No w/1.7 ev Probe --Headspace Sample								
BEGUN	COMPLETED	DRILLER	DRILLING EQUIPMENT			BORING DIA.	DEPTH (FT)						
8-9-94	8-9-94	Rock & Soil	4-1/4 I.D. HSA/6 Water Rotary			8	20'						
CORE RECOVERY (FT./%)		CORE BOXES	SAMPLES	ELEV. TOP CASING	GROUND ELEV.	DEPTH/ELEV. GROUND WATER		DEPTH/ELEV. TOP OF ROCK					
/		6	6	604.18	601.3	13.64' bgs / 587.65 AMSL		1.5 bgs / 589.8 AMSL					
SAMPLE DEVICE			DRILL CASING LEFT IN HOLE: DIA./LENGTH			LOGGED BY							
2 1/2" Sp. Spoon/300 lb. hammer						Dan Petersen							
SAMPLES/R.CORE				CONTAMINANT SCREENING			LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.	
Lab Sample # Time	Recovery (feet)	Length (feet)	Blow Count RQD (%)	Sample Scan* (Vppm)	Headspace** (Vppm)	Observations							
A	10	10	50/3	0.6	0.2		-2-				0.0-2.0' CLAY, brownish black, silty abundant cobbles, roots, dry.	Dri. with HSA above bedrock	
B	0.0	0.0	50/3	0.6	0.2					2.0-11.5' SAND/CLAY, SILTY, pale yellowish orange, light olive gray mottling coarse cobbles, dry	Soil spoon refusal, no recovery		
C	0.75	1.25	8 28 50/3	0.6	0.2			5					
D	0.75	1.0	26 50/6	0.2	0.2					Increase in cobble content			
E	0.5	0.5	50/6	0.2	0.2					Color change to light olive gray			
F	0.5	0.5	50/6					10		20% gravel, 20% clay			
							-11.5-			11.5-20.0 COLOMITE		Auger refusal at 11.5 feet; augers dried into bedrock approximately 1 foot; no water Dri. with water rotary in dolomite.	
							15						



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GEOLOGIC DRILL LOG				PROJECT/TASK ENAP INVESTIGATION		PROJECT NUMBER 9401REV	SHEET NO. 3 of 3	HOLE NUMBER P-19				
SITE LENZ OIL			COORDINATES N. 420.042; E339.054		CONTAMINANT SCREENING NOTES +No w/117 EV Probe +Headspace Sample							
BEGUN 8-9-94	COMPLETED 8-9-94	DRILLER Rock & Soil	DRILLING EQUIPMENT 4-1/4" I.D. HSA/6 Water Rotary			BORING DIA. 8	DEPTH (FT) 20'					
<i>Continued</i>												
Lab Sample # Time	Recovery (feet)	Length (feet)	Blow Count RQD (%)	CONTAMINANT SCREENING			LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
				Sample Scan* (Vppm)	Headspace** (Vppm)	Observations						
								15				Odor and speed of water
								-20 20			End of boring at 20 feet	
								25				
								30				



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GEOLOGIC DRILL LOG										PROJECT/TASK LIMAP INVESTIGATION		PROJECT NUMBER 94075V		SHEET NO. 1 of 3		HOLE NUMBER P-20	
SITE LEND OIL					COORDINATES N 379.625; E260.075					CONTAMINANT SCREENING NOTES **No w/17 ev Probe **Headspace Sample							
BEGUN 8-9-94		COMPLETED 8-9-94		DRILLER Rock & So			DRILLING EQUIPMENT 4-1/4 I.D. HSA/6" Water Rotary					BORING DIA. 8		DEPTH (FT) 20.5'			
CORE RECOVERY (FT./X) 7			CORE BOXES		SAMPLES 8		ELEV. TOP CASING 599.23		GROUND ELEV. 599.7		DEPTH/ELEV. GROUND WATER			DEPTH/ELEV. TOP OF ROCK 110' bgs / 588' AMSL			
SAMPLE DEVICE 2 1/2" Split Spoon/300 lb. hammer					DRILL CASING LEFT IN HOLE: DIA./LENGTH					LOGGED BY Dan Petersen							
SAMPLES/R.CORE				CONTAMINANT SCREENING			LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.					
Lab Sample # Time	Recovery (feet)	Length (feet)	Blow Count RQD (%)	Sample Scan* (Vppm)	Headspace** (Vppm)	Observations											
A	2.0	2.0	100/0		0.2						0.0-10' TOPSOIL, brownish black roots, dry.	Drill with HSA above bedrock.					
B	1.5	2.0	20/20 50/50		0.2						10-60' CLAYEY SILT pale yellowish orange, 10% gravel, dry						
C	1.75	2.0	9/25 25/25 29		0.2						Cobbles silt layered pale yellowish orange and light olive gray						
											Increase in cobble content.						
D	0.0	0.0	50/0		0.8						Wet at 6 feet.						
E	1.5	1.5	12/12 3/3 50/0		1.8						6.0-11.5' CLAYEY GRAVEL TO CLAYEY SILTY GRAVEL, light olive gray, up to 40% angular gravel, well graded, dense, dry to moist						
F	0.5	1.5	12/12 13/13 50/0														
						sheen					11.5-20.0' DOLOMITE	Auger refusal, ream with augers to 12 feet BGS, no water.					
												Drill with water rotary to TD.					



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GEOLOGIC DRILL LOG			PROJECT/TASK UNAPL INVESTIGATION	PROJECT NUMBER 940175	SHEET NO. 1 of 2	HOLE NUMBER P-20
SITE LEWIS OIL		COORDINATES N 379.625; E 260.075		CONTAMINANT SCREENING NOTES •H ₂ O w/ 1.7 ev Probe ••Headspace Sample		
BEGUN 8-9-94	COMPLETED 8-9-94	DRILLER Rock & Soil	DRILLING EQUIPMENT 4-1/4" I.D. HSA/6" Water Rotary		BORING DIA. 8"	DEPTH (FT) 20.5'

Continued

SAMPLES/R.CORE				CONTAMINANT SCREENING			LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
Lab Sample #	Time	Recovery (feet)	Length (feet)	Blow Count RQD (%)	Sample Scan* (Vppm)	Headspace** (Vppm)						
						screen		15				Green and brown liquid on water in boring
								20			End of boring at 20 feet.	
								25				
								30				

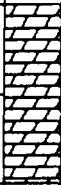
GEOLOGIC DRILL LOG										PROJECT/TASK UNAPL INVESTIGATION		PROJECT NUMBER 94017EM		SHEET NO. 1 of 2		HOLE NUMBER P-21	
SITE LEND OIL					COORDINATES N. 366.625; E376.139					CONTAMINANT SCREENING NOTES *H ₂ O w/11.7 ev Probe **Headspace Sample							
BEGUN 8-9-94		COMPLETED 8-9-94		DRILLER Rock & Soil			DRILLING EQUIPMENT 4-1/4" I.D. HSA/6" Water Rotary					BORING DIA. 8		DEPTH (FT) 17'			
CORE RECOVERY (FT./%) /			CORE BOXES 3		SAMPLES 601.03		ELEV. TOP CASING 598.5		GROUND ELEV. 10.63' bgs / 587.87 AMSL		DEPTH/ELEV. GROUND WATER 4.0' bgs / 584.5 AMSL		DEPTH/ELEV. TOP OF ROCK				
SAMPLE DEVICE 2'x3' Split Spoon/300 lb. hammer					DRILL CASING LEFT IN HOLE: DIA./LENGTH					LOGGED BY Dan Petersen							
SAMPLES/R.CORE				CONTAMINANT SCREENING			LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.					
Lab Sample # Time	Recovery (feet)	Length (feet)	Blow Count RCD (%)	Sample Scan* (Vppm)	Headspace** (Vppm)	Observations											
A	2.0	2.0	50/60		0.5						0.0-1.0' TOP SOIL: brownish black, roots grave, dry.						
B	0.5	0.5	50/6		0.5						1.0-4.0' PEBBLY SILT: pale yellowish orange, trace of sand and clay, dry						
C	0.0	0.0	50/0								4.0-17.0' DOLOMITE						



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GEOLOGIC DRILL LOG			PROJECT/TASK UNAPL INVESTIGATION	PROJECT NUMBER 9407EM	SHEET NO. 2 of 2	HOLE NUMBER P-21
SITE LENI OIL		COORDINATES N. 366.625; E376.139		CONTAMINANT SCREENING NOTES •HNU w/11.7 kv Probe ••headsapce Sample		
BEGUN 8-9-94	COMPLETED 8-9-94	DRILLER Rock & Soil	DRILLING EQUIPMENT 4-1/4" I.D. HSA/6 Water Rotary		BORING DIA. 8"	DEPTH (FT) 17'

Continued

SAMPLES/R. CORE				CONTAMINANT SCREENING			LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
Lab Sample #	Time	Recovery (feet)	Length (feet)	Blow Count RQD (%)	Sample Scan* (Vppm)	Headspace** (Vppm)						
								15				
								17			End of boring at 17 feet	
								20				
								25				
								30				



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GEOLOGIC DRILL LOG				PROJECT/TASK LAPL INVESTIGATION		PROJECT NUMBER 9407EM	SHEET NO. 1 of 1	HOLE NUMBER P-22				
SITE LENZ OIL			COORDINATES N 508.250; E 471.652		CONTAMINANT SCREENING NOTES *-No w/11.7 ev Probe **Headspace Sample							
BEGUN 8-5-94	COMPLETED 8-5-94	DRILLER Rock & Soil		DRILLING EQUIPMENT Acker Soil Max. 4-1/4 I.D. HSA			BORING DIA. 8"	DEPTH (FT) 13.5'				
CORE RECOVERY (FT./%) /		CORE BOXES /	SAMPLES 7	ELEV. TOP CASING /	GROUND ELEV. 601.430	DEPTH/ELEV. GROUND WATER /		DEPTH/ELEV. TOP OF ROCK 13.5' bgs / 587.9 AMSL				
SAMPLE DEVICE 2"x3" Split Spoon/300 lb. hammer			DRILL CASING LEFT IN HOLE: DIA./LENGTH /				LOGGED BY Dan Pedersen					
Lab Sample # Time	Recovery (feet)	Length (feet)	Blow Count ROD (%)	CONTAMINANT SCREENING			LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
				Sample Scan** (Vppm)	Headspace** (Vppm)	Observations						
A	1.5	2.0	3 24 50/5		0.4						0.0-1.3' TOPSOIL, gray sh brown, gravel, roots, moist.	Cobbles in split spoon tip.
B	1.4	1.5	8 24 50/5		0.8						1.3-8.0' CLAYEY SILT, dark yellow sh orange, trace pebbles, dry.	
C	0.75	1.5	10 40 50/5		0.8						Some oxidized mottling.	
D	1.5	2.0	12 29 36 50		1.2						Fewer cobbles and pebbles, less clay, light olive gray mottling	
E	1.3	1.3	29 33 50/4		1.6						8.0-13.5' CLAYEY GRAVE, light olive gray, 10% sand and silt, dense, cohesive, angular grave, size up to 1", moist.	Split spoon refusal. How reading off auger cuttings = 10 Vppm
F	0.0	0.0	50/0									
G	0.0	0.0	50/0								Split spoon refusal.	
											End of boring at 13.5 feet.	



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GEOLOGIC DRILL LOG				PROJECT/TASK LNAPL INVESTIGATION		PROJECT NUMBER 94017EM		SHEET NO. 1 of 2		HOLE NUMBER P-23		
SITE LENZ OIL				COORDINATES N 484.777; E196.287		CONTAMINANT SCREENING NOTES +HNO ₃ w/11.7 ev Probe **Headspace Sample						
BEGUN 9-12-94		COMPLETED 9-12-94		DRILLER Rock & Soil		DRILLING EQUIPMENT 4-1/4" I.D. HSA				BORING DIA. 8"		
CORE RECOVERY (FT./%) /		CORE BOXES		SAMPLES		ELEV. TOP CASING 600.87		GROUND ELEV. 601.186		DEPTH/ELEV. GROUND WATER 6.0' bgs / 595.19 AMSL 13.5' bgs / 587.69 AMSL		
SAMPLE DEVICE 2"x3" Split Spoon/300 lb. hammer				DRILL CASING LEFT IN HOLE: DIA./LENGTH				LOGGED BY Danie W. Petersen				
SAMPLES/R.CORE				CONTAMINANT SCREENING			LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
Lab Sample # Time	Recovery (feet)	Length (feet)	Blow Count ROD (%)	Sample Scan** (Vppm)	Headspace** (Vppm)	Observations						
A	2.0	2.0	7 14 14 21		0.0						0.0-7.0' <u>ELUV. Gravel to gravelly silt</u> pale yellowish orange, well graded, rounded, dry to saturated.	
B	2.0	2.0	28 21 29 40		0.0							
C	2.0	2.0	24 34 42 60		0.5							
D	2.0	2.0	26 25 31 35		-							
E	2.0	2.0	7 10 30 33		60	strong gas odor					7.0-10.0' <u>INTERBEDDED CLAYEY SILT AND SILTY CLAY</u> ; Clayey silt is medium gray, dense, moist to wet, oxidized fractures; silty clay is medium gray with trace of well rounded pebbles, moist.	
F	1.9	2.0	9 25 29 40		-						10.0-13.5' <u>PEBBLY SILTY CLAY</u> ; Medium gray, 35% silt, 10% pebbles, dry	
G	1.75	1.75	15 27 24 50/3		10							
H	0.0	0.0	ref		-						13.5-20.5' <u>DOLOMITE</u> ; light gray dolomite, saturated	



ERM-North Central, Inc.

Environmental Resources Management

GEOLOGIC DRILL LOG

PROJECT/TASK

LNAPL INVESTIGATION

PROJECT NUMBER

94017EM

SHEET NO.

2 of 2

HOLE NUMBER

P-23

SITE

LENZ OIL

COORDINATES

N 484.717; E198.287

CONTAMINANT SCREENING NOTES

•HNU w/11.7' Ev Probe ••Headspace Sample

BEGUN

9-12-94

COMPLETED

9-12-94

DRILLER

Rock & Soil

DRILLING EQUIPMENT

4-1/4" I.D. HSA

BORING DIA.

8"

DEPTH (FT)

20.5'

Continued

SAMPLES/R.CORE				CONTAMINANT SCREENING			LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
Lab Sample # Time	Recovery (feet)	Length (feet)	Blow Count RCD (%)	Sample Scan** (Vppm)	Headspace** (Vppm)	Observations						
1	0.0	0.0	re		7			15				
1	0.2	0.2	60/3					20				
								20.5				
								25				
								30				
											End of boring at 20.5 feet.	



ERM-North Central, Inc.

Environmental Resources Management

GEOLOGIC DRILL LOG				PROJECT/TASK		PROJECT NUMBER	SHEET NO.	HOLE NUMBER				
LENZ OIL				ENVIRONMENTAL INVESTIGATION		9407EM	1 of 2	P-24				
SITE			COORDINATES		CONTAMINANT SCREENING NOTES							
9-12-94			N 303.666; E194.745		*No w/11.7 ev Probe **Headspace Sample							
BEGUN	COMPLETED	DRILLER	DRILLING EQUIPMENT			BORING DIA.	DEPTH (FT)					
9-12-94	9-12-94	Rock & So	4-1/4" I.D. HSA			8"	17.0'					
CORE RECOVERY (FT./%)		CORE BOXES	SAMPLES	ELEV. TOP CASING	GROUND ELEV.	DEPTH/ELEV. GROUND WATER		DEPTH/ELEV. TOP OF ROCK				
/				596.9'	595.76'	2' bgs / 593.76AMS 12.0' bgs / 593.76AMS		10.0' bgs / 595.8AMS				
SAMPLE DEVICE			DRILL CASING LEFT IN HOLE: DIA./LENGTH			LOGGED BY						
2'x3" Split Spoon/300 lb. hammer						Daniel W. Petersen						
SAMPLES/R. CORE				CONTAMINANT SCREENING			LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
Lab Sample # Time	Recovery (feet)	Length (feet)	Blow Count ROD (X)	Sample Scan* (Vppm)	Headspace** (Vppm)	Observations						
A	15	2.0	8 18 22 24	0.0	0.0						0.0-0.5' TOPSOIL. Back-filled trace of sand.	
B	15	2.0	8 18 22 24	0.0	0.0						0.5-2.5' GRAVELLY SILT TO GRAVE. Pale yellowish orange, trace of clay. Gravel is angular, saturated.	
C	15	2.0	8 18 26 18	0.5	0.5						2.5-5.0' SILT TO CLAYEY SILT. Pale yellowish orange, trace of well rounded gravel, dry.	
D	0.0	2.0	15 28 21 16	-	-						5.0-8.0' SILTY CLAY. Light olive gray, trace of angular gravel, moist.	
E	1.0	1.3	40 50/21	60	60	strong gas odor					8.0-10.0' CLAYEY GRAVE. Medium gray, well graded, angular, 40% clay, 60% gravel, moist.	
F	0.0	0.0	50/0	-	-						10.0-17.0' COLOMITE. Light gray, dolomitic stone, saturated at 12.0' bgs, no oil staining.	Water level in piezometer rose to 7' BGS after well installation.
G	0.3	0.33	30/41	10	10							
H	0.5	0.5	50/61	7	7							



ERM-North Central, Inc.

Environmental Resources Management

GEOLOGIC DRILL LOG				PROJECT/TASK		PROJECT NUMBER	SHEET NO.	HOLE NUMBER				
LEND OIL				LAPL INVESTIGATION		9407EV	2 of 2	P-24				
SITE		COORDINATES		CONTAMINANT SCREENING NOTES								
LEND OIL		N 303.666; E 194.745		*HNU w/11.7 ev Probe **headspace Sample								
BEGUN	COMPLETED	DRILLER	DRILLING EQUIPMENT			BORING DIA.	DEPTH (FT)					
9-12-94	9-12-94	Rock & Soil	4-1/4 I.D. HSA			8	17.0'					
Continued												
SAMPLES/R.CORE				CONTAMINANT SCREENING			LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
Lab Sample # Time	Recovery (feet)	Length (feet)	Blow Count ROD (%)	Sample Scan** (Vppm)	Headspace** (Vppm)	Observations						
1	0.5	0.5	50/6		7			15				
								17				
								20				
								25				
								30				
											End of boring at 17 feet	



ERM-North Central, Inc.

Environmental Resources Management

GEOLOGIC DRILL LOG				PROJECT/TASK		PROJECT NUMBER	SHEET NO.	HOLE NUMBER				
				UNAPL INVESTIGATION		94017EM	1011	P-24S				
SITE			COORDINATES		CONTAMINANT SCREENING NOTES							
LENZ OIL					**NU W/11.7 ev Probe **Headspace Sample							
BEGUN	COMPLETED	DRILLER	DRILLING EQUIPMENT			BORING DIA.	DEPTH (FT)					
10-14-94	10-14-94	Rock & So	4-1/4 I.D. HSA			10	13.5'					
CORE RECOVERY (FT./%)		CORE BOXES	SAMPLES	ELEV. TOP CASING	GROUND ELEV.	DEPTH/ELEV. GROUND WATER		DEPTH/ELEV. TOP OF ROCK				
/						9.5' bgs		8.5' bgs				
SAMPLE DEVICE			DRILL CASING LEFT IN HOLE: DIA./LENGTH			LOGGED BY						
2'x3' Split Spoon/300 lb. hammer						Danie W. Petersen						
SAMPLES/R.CORE				CONTAMINANT SCREENING			LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
Lab Sample # Time	Recovery (feet)	Length (feet)	Blow Count RQD (%)	Sample Scan* (Vppm)	Headspace** (Vppm)	Observations						
A	2.0	2.0	3 100%		0.2						0.0-0.5' TOPSOIL. Black, rooted, trace of sand	
B	15	2.0	6 18 24 22		0.2						0.5-8.5' PEBBLY SILT TO PEBBLY CLAYEY SILT. Medium gray mottled with yellowish orange, trace of doomite pebbles and cobbles, dry with wet seams at 4.8 and 4.9 feet bgs. These seams did not generate water in boring	
C	2.0	2.0	8 19 25 21		0.4							
D	15	2.0	7 21 23 21		7.0	strong gas odor						
E	0.5	0.75	8 50/3								10.0-13.5' DOLOMITE. Light gray doolomite, saturated at 9.5' bgs, no oil staining	
												Water level rose to approximately 5.2' BGS after well installation.
											End of boring at 13.5 feet	

GEOLOGIC DRILL LOG

PROJECT/TASK	UNAPL INVESTIGATION
--------------	---------------------

PROJECT NUMBER	9407EM
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SHEET NO.
102

HOLE NUMBER
P-25

SITE
LENZ OIL

COORDINATES
N 303.055; E301.395

CONTAMINANT SCREENING NOTES
 * = ND w/ 1" Ev Probe * = Headspace Sample

BEGUN
9-12-94

COMPLETED
9-12-94

DRILLER
Rock & Soil

DRILLING EQUIPMENT
4-1/4" I.D. HSA

BORING DIA.	
8"	

DEPTH (FT)
16.0'

CORE RECOVERY (FT./%)

CORE BOXES

SAMPLES	
1	100
2	100
3	100
4	100
5	100
6	100
7	100
8	100
9	100
10	100
11	100
12	100
13	100
14	100
15	100
16	100
17	100
18	100
19	100
20	100
21	100
22	100
23	100
24	100
25	100
26	100
27	100
28	100
29	100
30	100
31	100
32	100
33	100
34	100
35	100
36	100
37	100
38	100
39	100
40	100
41	100
42	100
43	100
44	100
45	100
46	100
47	100
48	100
49	100
50	100
51	100
52	100
53	100
54	100
55	100
56	100
57	100
58	100
59	100
60	100
61	100
62	100
63	100
64	100
65	100
66	100
67	100
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69	100
70	100
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76	100
77	100
78	100
79	100
80	100
81	100
82	100
83	100
84	100
85	100
86	100
87	100
88	100
89	100
90	100
91	100
92	100
93	100
94	100
95	100
96	100
97	100
98	100
99	100
100	100

ELEV. TOP CASING	597.95
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GROUND ELEV.
595.662

DEPTH/ELEV. GROUND WATER

DEPTH/ELEV. TOP OF ROCK	90' bgs / 5367 AMSL
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SAMPLE DEVICE

2'x3" Split Spoon/300 lb. hammer

DRILL CASING LEFT IN HOLE: DIA./LENGTH

LOGGED BY	
-----------	--

Daniel W. Petersen

SAMPLES/R.CORE				CONTAMINANT SCREENING			LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
Lab Sample # Time	Recovery (feet)	Length (feet)	Blow Count RQD (%)	Sample Scan** (Vppm)	Headspace** (Vppm)	Observations						
A	1.5	2.0	3 4 7		0.0						0.0-4.0' <u>FILL</u> . Moderate yellowish brown silty clay, trace of pebbles, dry.	
B	2.0	2.0	4 5 6 4		0.0							
C	0.7	0.7	4 50/2		0.0			5			4.0-6.0' <u>TOP SOIL</u> . Dark brown, rooted, cobbles, dry.	
D	0.0	0.0	ref		-						6.0-9.0' <u>CLAYEY GRAVEL</u> . Light gray cobbles with medium gray silty clay moist.	
E	50/4	0.33	50/4		-							
F	0.2	0.3	50/2		1.5			10				
G	0.2	0.3	50/2		0.2						9.0-16.0' <u>DOLOMITE</u> . Light gray, dolomitic stone, saturated at 9.5' bgs. no oil staining.	
								15				



ERM-North Central, Inc.

Environmental Resources Management

GEOLOGIC DRILL LOG

PROJECT/TASK
LNAPL INVESTIGATION

PROJECT NUMBER
94017EM

SHEET NO.
2 of 2

HOLE NUMBER
P-25

SITE
LENZ OIL

COORDINATES
N 303.055; E301.396

CONTAMINANT SCREENING NOTES
*HNU w/11.7 eV Probe **Headspace Sample

BEGUN
9-12-94

COMPLETED
9-12-94



DRILLER
Rock & Soil

DRILLING EQUIPMENT
4-1/4" I.D. HSA

BORING DIA.
8"

DEPTH (FT)
16.0'

Continued

SAMPLES/R.CORE				CONTAMINANT SCREENING			LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
Lab Sample # Time	Recovery (feet)	Length (feet)	Blow Count RCD (%)	Sample Scan* (Vppm)	Headspace** (Vppm)	Observations						
								15				
								16			End of boring at 16 feet.	
								20				
								25				
								30				



PROJECT/TASK	UNAP INVESTIGATION
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PROJECT NUMBER	3407EM
----------------	--------

SHEET NO.
202

HOLE NUMBER
P-26

SITE
LENE OIL

COORDINATES
N. 3°0.660; E 438.855

CONTAMINANT SCREENING NOTES
*-Nu w/11.7 eV Probe **Headspace Sample

BEGUN
9-13-94

COMPLETED
9-13-94


DRILLER	Rock & Soil
---------	-------------

DRILLING EQUIPMENT
4-1/4" I.D. HSA

BORING DIA.
8"

DEPTH (FT)	19.0'
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Continued

SAMPLES/R.CORE				CONTAMINANT SCREENING			LAYER DEPTH	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION density, grain size/shape, color, structure composition, sorting, texture, moisture facies, odor	DRILLING NOTES water levels, water return, character of drilling, etc.
Lab Sample # Time	Recovery (feet)	Length (feet)	Blow Count RQD (%)	Sample Scan** (Vppm)	Headspace** (Vppm)	Observations						
								15				
								-19			End of boring at 19 feet.	
								20				
								25				
								30				



ERM-North Central, Inc.

Environmental Resources Management

GEOLOGIC DRILL LOG				PROJECT/TASK LNAPL INVESTIGATION		PROJECT NUMBER 9407EM	SHEET NO. 1 of 1	HOLE NUMBER G102S	
SITE LENZ CIL		COORDINATES		CONTAMINANT SCREENING NOTES *HNU w/11.7' Ev. Probe **headspace Sample					
BEGUN 10-14-94	COMPLETED 10-14-94	DRILLER Rock & So		DRILLING EQUIPMENT 4-1/4" I.D. HSA			BORING DIA. 10"	DEPTH (FT) 15.0'	
CORE RECOVERY (FT./%) /		CORE BOXES	SAMPLES	ELEV. TOP CASING	GROUND ELEV.	DEPTH/ELEV. GROUND WATER NO ENCOUNTERED 13.5' bgs		DEPTH/ELEV. TOP OF ROCK 7.5' bgs	
SAMPLE DEVICE 2'x3' Split Spoon/300 lb. hammer				DRILL CASING LEFT IN HOLE: DIA./LENGTH			LOGGED BY Daniel W. Petersen		
SAMPLES/R.CORE				CONTAMINANT SCREENING			DRILLING NOTES water levels, water return, character of drilling, etc.		
Lab Sample # Time	Recovery (feet)	Length (feet)	Blow Count ROD (%)	Sample Scan** (Vppm)	Headspace** (Vppm)	Observations			
A	2.0	2.0	100		0.0			0.0-3.0' <u>SILT</u> Clayey silt moderate yellowish brown, 10% gravel loose dry	
B	2.0	2.0	7 23 43 60/4		2.0			3.0-7.5' <u>SILT</u> Yellowish gray, trace of clay and cobbles, with increasing silt content downwards, dry.	
C	2.0	2.0	15 33 37 67		0.0				
D	1.5	1.5	14 24 16 ret		0.0			7.5-15.0' <u>DOLOMITE</u> Tan to light gray, dolomestone, weathered at top, saturated at 12.5' bgs.	
									Pulled up augers to let boring make water. No water collected.
									Water level rose to approximately 9.5' BGS prior to well installation.

APPENDIX B
MONITORING WELL CONSTRUCTION LOGS



ERM-North Central, Inc.

Environmental Resources Management

WELL CONSTRUCTION LOG

PROJECT/TASK

LNAPL INVESTIGATION

PROJECT NUMBER

94017EM

WELL NUMBER

P-01

Casing
stickup 2.5
ft.

WELL HEAD NOTES:
Steel Protector

Ground Surface

2

3.0

5

6

16

Concrete

~8-inch Diameter Drilled
Hole

2-inch Diameter, #304
Stainless Steel Riser

Bentonite Pellets

2-inch Diameter, #304
Stainless Steel, 10-Slot
Screen

Sand Filter Pack

Associated Soil Boring P-01

City Lemont

County and State DuPage, Illinois

Ground Surface Elevation 600.3 AMSL

Measuring Point Elevation 603.03

☒ Surveyed ☐ Estimated

Installation Date (s) 8-2-94

Drilling Method Acker Soil Mix, 4-1/4 I.D. HSA

Drilling Contractor Rock & Soil

Drilling Fluid

Development Technique (s) / Dates

Bailer - 8/8/94

Fluid Loss During Drilling (gals)

Water Removed During Development (gals)

4.5 8/8/94

Static Water Level Depth (feet) 9.45

Date Water Level Measured 8-19-94

Well Purpose LNAPL Investigation

Remarks

Prepared By Dean Jacobsen

Location ERM-North Central



ERM-North Central, Inc.

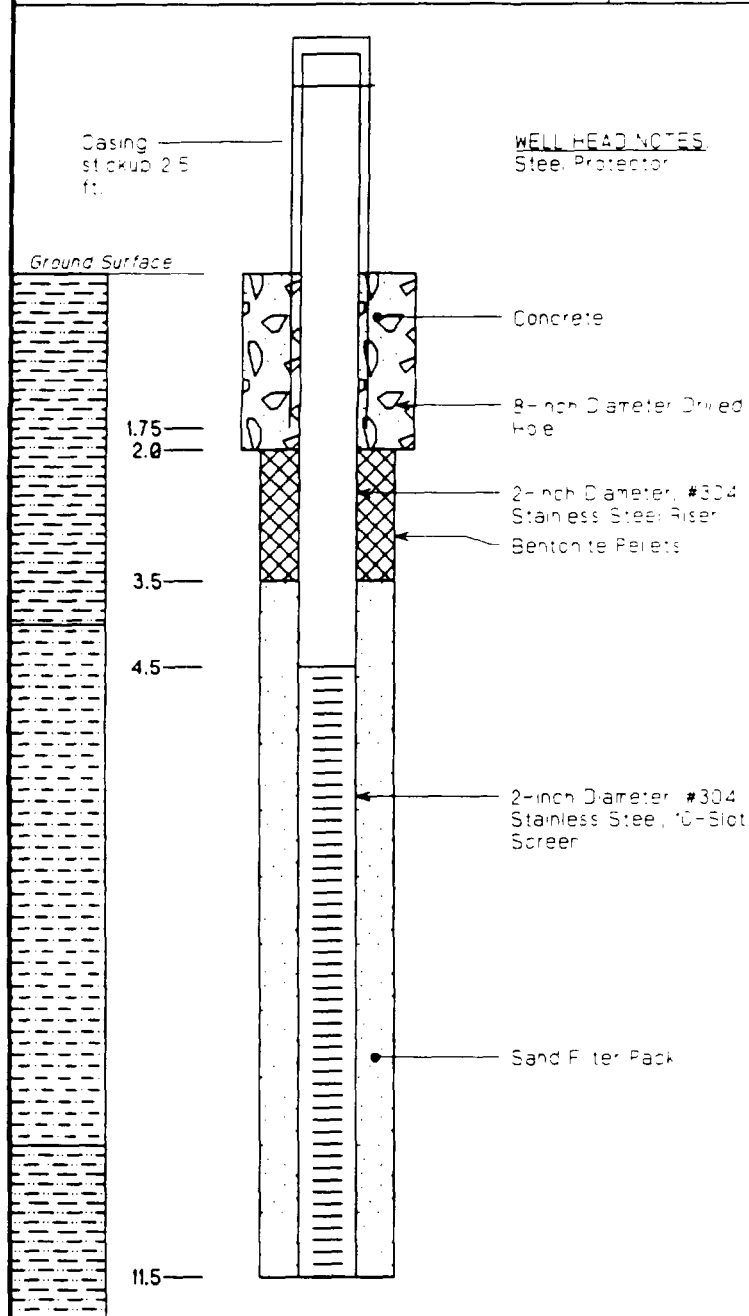
Environmental Resources Management

WELL CONSTRUCTION LOG

PROJECT/TASK
LNAPL INVESTIGATION

PROJECT NUMBER
94017EM

WELL NUMBER
P-05



Associated Soil Boring P-05

City Lemont

County and State DuPage, Illinois

Ground Surface Elevation 600.1 AMSL

Measuring Point Elevation 602.84

☒ Surveyed ☐ Estimated

Installation Date (s) 8-5-94

Drilling Method Acker Soil Max 4-1/2 I.D. HSD

Drilling Contractor Rock & Soil

Drilling Fluid _____

Development Technique (s) / Dates

Bailer - 8-8-94

Fluid Loss During Drilling (gals) _____

Water Removed During Development (gals)

2.3 8-8-94

Static Water Level Depth (feet) 9.19

Date Water Level Measured 8-19-94

Well Purpose LNAPL Investigation

Remarks _____

Prepared By Dean Jacobson

Location ERM-North Central

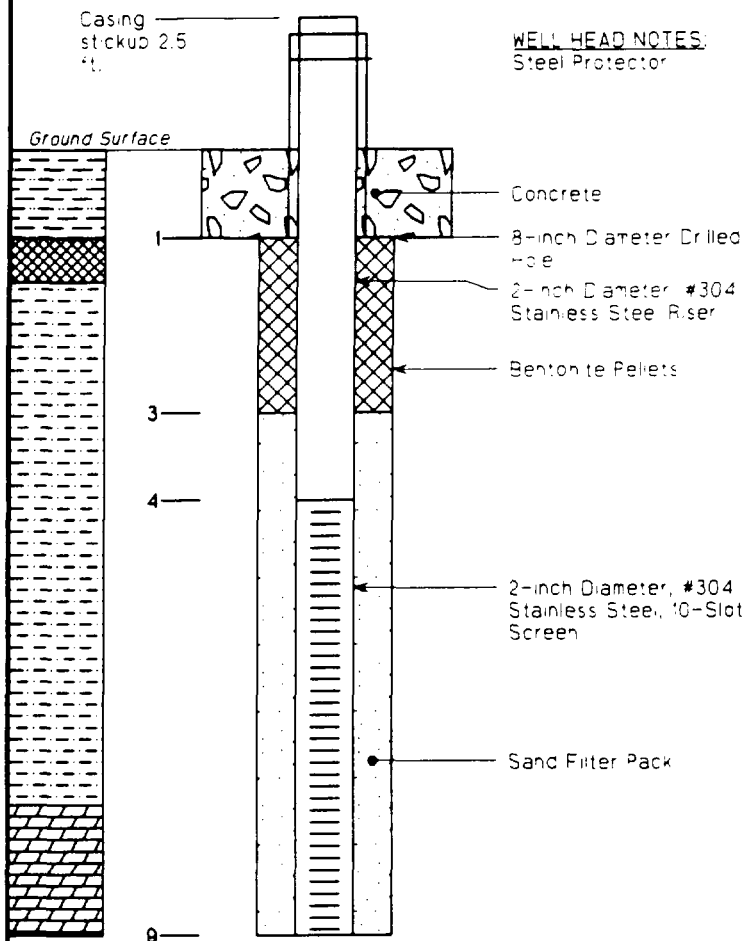


WELL CONSTRUCTION LOG

PROJECT/TASK
LNAPL INVESTIGATION

PROJECT NUMBER
94017EM

WELL NUMBER
P-06



WELL HEAD NOTES:
Steel Protector

Associated Soil Boring P-06

City Lemont

County and State DuPage, Illinois

Ground Surface Elevation 600.7 AMSL

Measuring Point Elevation 603.83

☒ Surveyed ☐ Estimated

Installation Date (s) 8-2-94

Drilling Method Acker Soil Max 4-1/4" I.D. HSA

Drilling Contractor Rock & Soil

Drilling Fluid _____

Development Technique (s) / Dates

Bailer - 8/8/94

Fluid Loss During Drilling (gals) _____

Water Removed During Development (gals)

0.4 8/8/94

Static Water Level Depth (feet) 9.67

Date Water Level Measured 8-13-94

Well Purpose LNAPL Investigation

Remarks _____

Prepared By _____

Location _____



ERM-North Central, Inc.

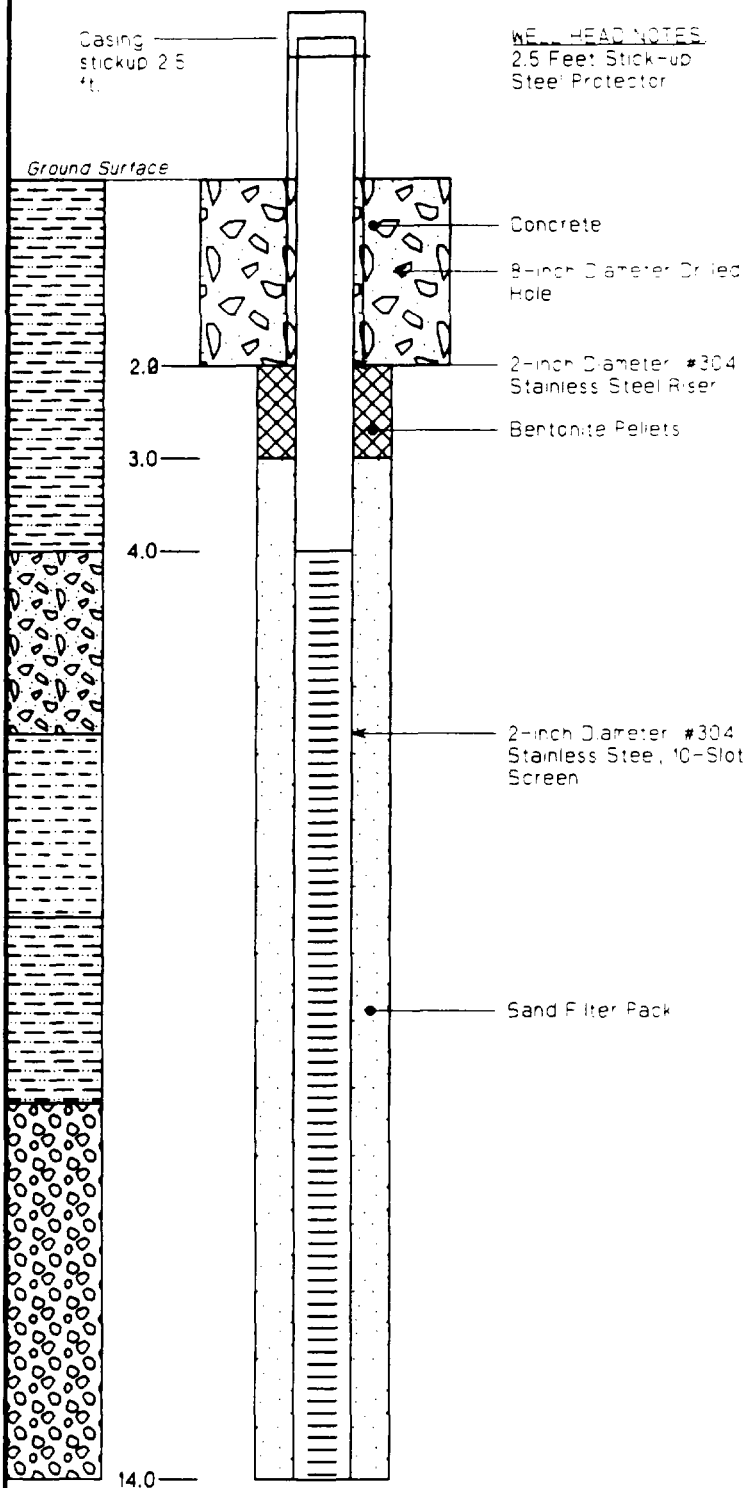
Environmental Resources Management

WELL CONSTRUCTION LOG

PROJECT/TASK
LNAPL INVESTIGATION

PROJECT NUMBER
94017EN

WELL NUMBER
P-07



Associated Soil Boring P-07

City Lemont

County and State DuPage, Illinois

Ground Surface Elevation 598.8 AMSL

Measuring Point Elevation 600.55

☒ Surveyed ☐ Estimated

Installation Date (s) 8-5-94

Drilling Method Acker Soil Max. 4-1/4 I.D. HSA

Drilling Contractor Rock & Soil

Drilling Fluid _____

Development Technique (s) / Dates

Bailer - 8/8/94

Fluid Loss During Drilling (gals) _____

Water Removed During Development (gals)

4.5

Static Water Level Depth (feet) 7.04

Date Water Level Measured 8-19-94

Well Purpose LNAPL Investigation

Remarks _____

Prepared By Dean Jacobsen

Location ERM-North Central



ERM-North Central, Inc.

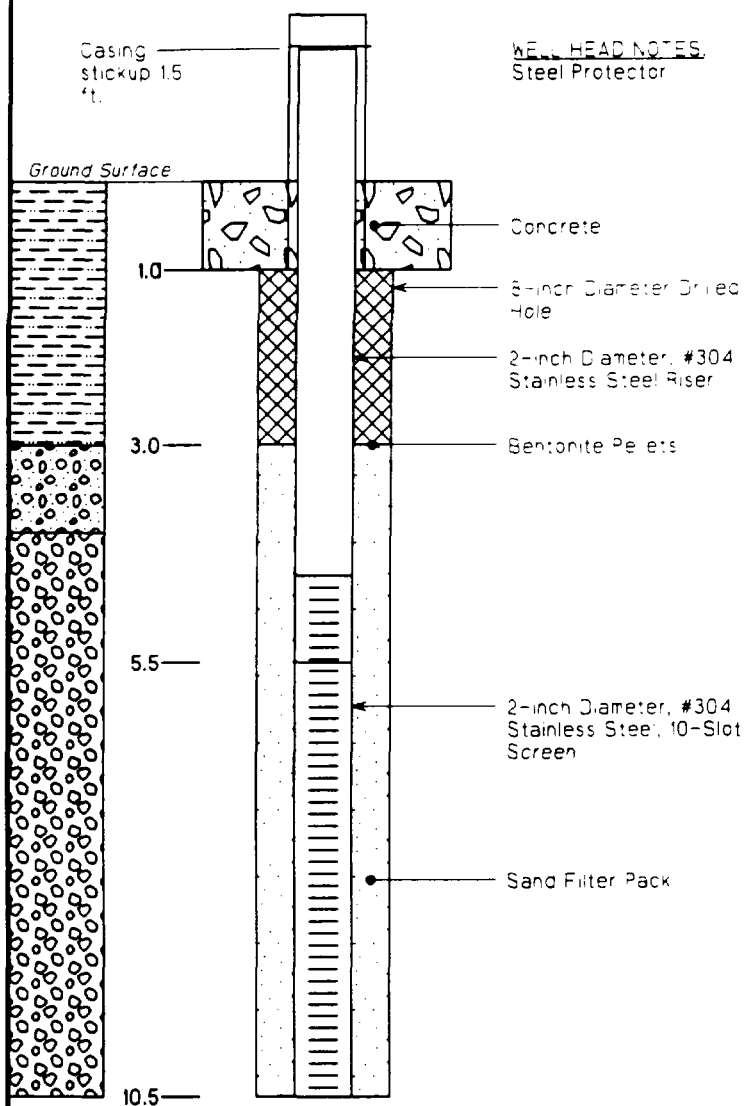
Environmental Resources Management

WELL CONSTRUCTION LOG

PROJECT/TASK
LNAPL INVESTIGATION

PROJECT NUMBER
940175

WELL NUMBER
P-08



Associated Soil Boring P-08

City Lemont

County and State DuPage, Illinois

Ground Surface Elevation 598.8 AMSL

Measuring Point Elevation 600.81

☒ Surveyed ☐ Estimated

Installation Date (s) 8-5-94

Drilling Method Acker Soil Max 4-1/4 I.D. HSA

Drilling Contractor Rock & Soil

Drilling Fluid _____

Development Technique (s) / Dates

Bailer - 8/8/94

Fluid Loss During Drilling (gals) _____

Water Removed During Development (gals)

2 8/8/94

Static Water Level Depth (feet) 7.28

Date Water Level Measured 8-19-94

Well Purpose LNAPL Investigation

Remarks well bailed dry at

2 gallons.

Prepared By Dean Jacobsen

Location ERM-North Central



ERM-North Central, Inc.

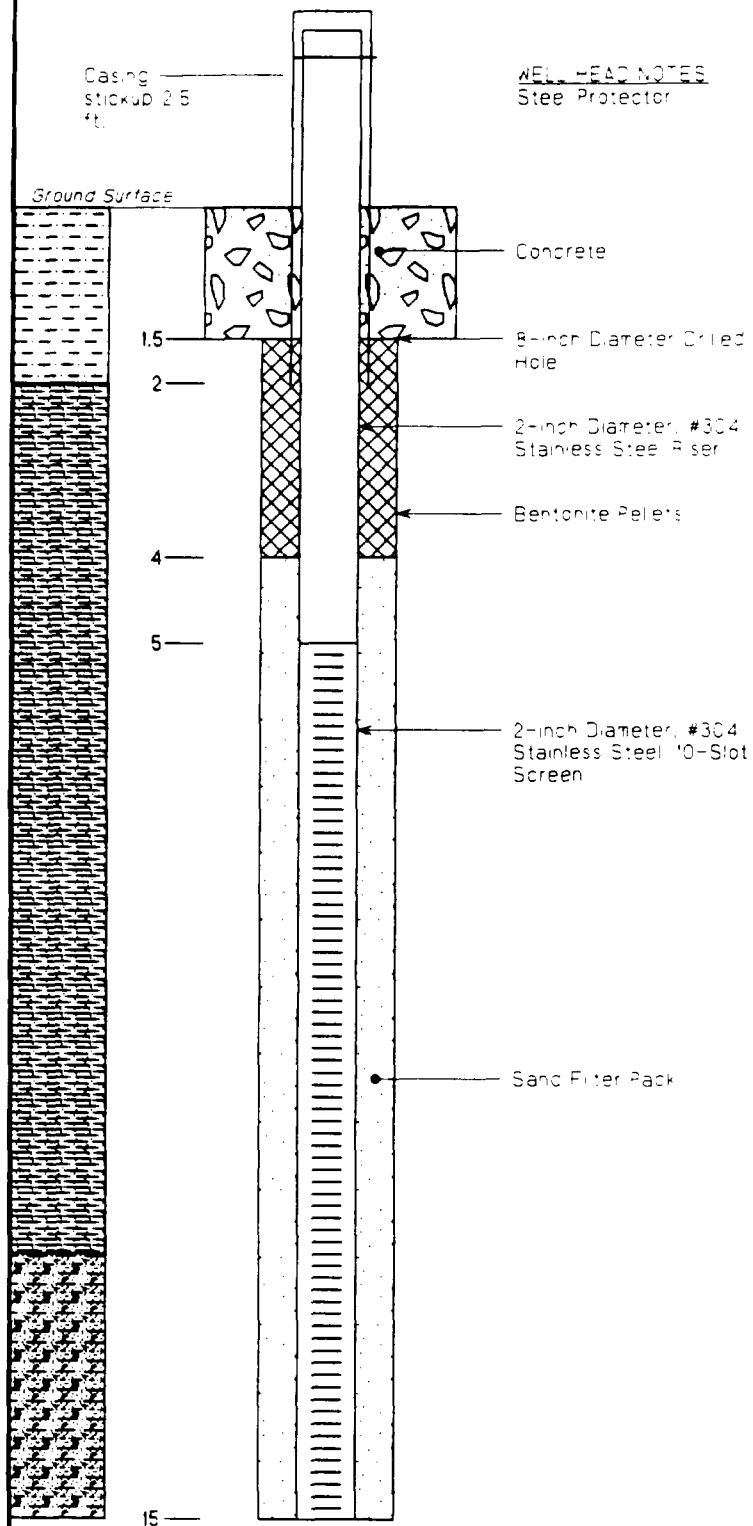
Environmental Resources Management

WELL CONSTRUCTION LOG

PROJECT/TASK
LNAPL INVESTIGATION

PROJECT NUMBER
940175M

WELL NUMBER
P-09



Associated Soil Boring P-09

City Lemont

County and State DuPage, Illinois

Ground Surface Elevation 600.8 AMSL

Measuring Point Elevation 603.62

☒ Surveyed ☐ Estimated

Installation Date (s) 8-1-94

Drilling Method Acker Soil Max 4-1/4 I.D. HSA

Drilling Contractor Rock & Soil

Drilling Fluid _____

Development Technique (s) / Dates

Bailer - 8/8/94

Fluid Loss During Drilling (gals) _____

Water Removed During Development (gals)

4 8/8/94

Static Water Level Depth (feet) 10.40

Date Water Level Measured 8-19-94

Well Purpose LNAPL Investigation

Remarks Slight seepage
water.

Prepared By Dean Jacobsen

Location ERM-North Central

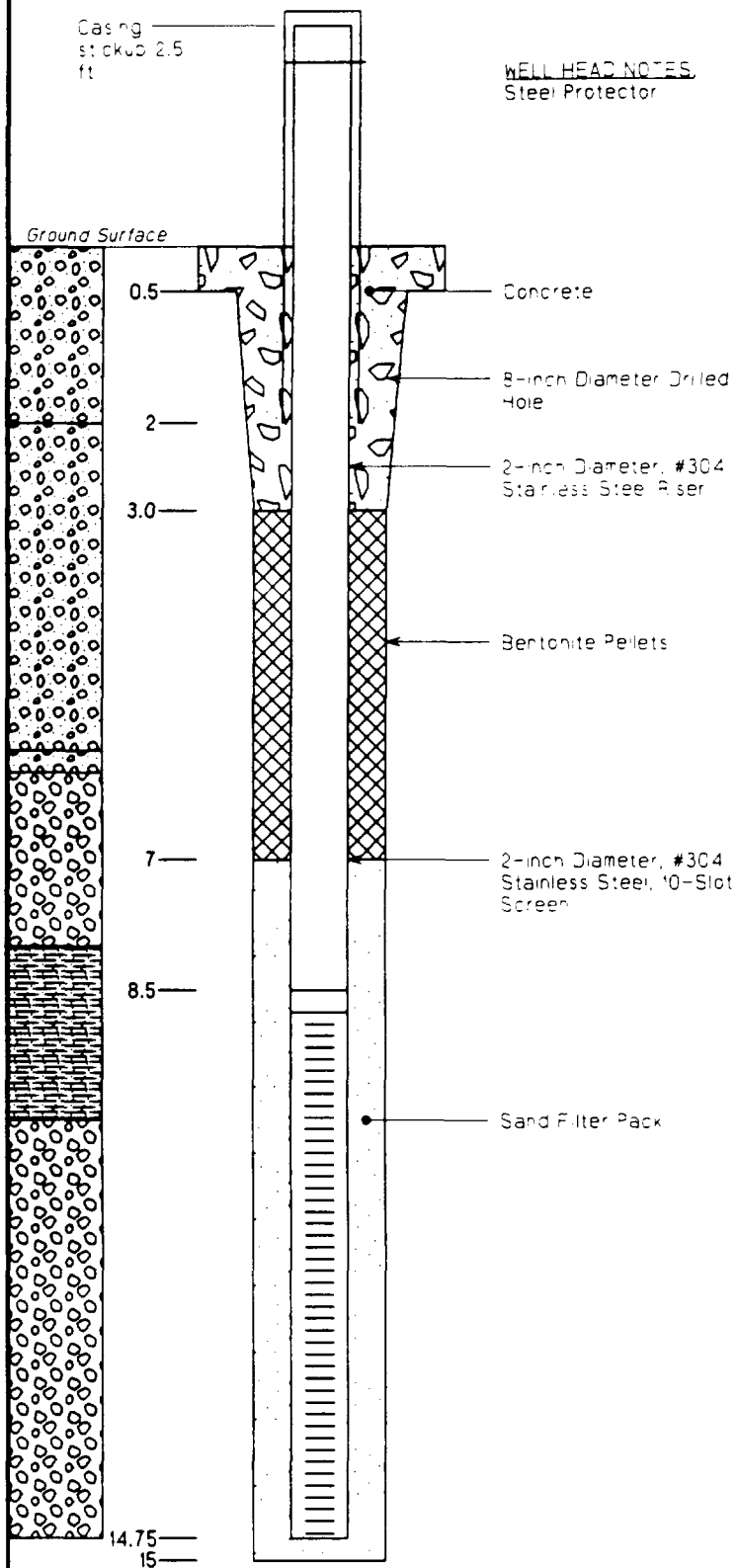


WELL CONSTRUCTION LOG

PROJECT/TASK
LNAPL INVESTIGATION

PROJECT NUMBER
94017EM

WELL NUMBER
P-13



Associated Soil Boring P-13

City Lemont

County and State DuPage, Illinois

Ground Surface Elevation 600.815 AMSL

Measuring Point Elevation 603.78

☒ Surveyed ☐ Estimated

Installation Date (s) 8-3-94

Drilling Method Acker Soil Max 4-1/4 I.D. HSA

Drilling Contractor Rock & Soil

Drilling Fluid

Development Technique (s) / Dates

Bailer - 8/10/94

Fluid Loss During Drilling (gals)

Water Removed During Development (gals)

1.5 8/12/94

Static Water Level Depth (feet) 12.40

Date Water Level Measured 9/16/94

Well Purpose LNAPL Investigation

Remarks Shown on water.

Prepared By Dean Jacobson

Location ERM-North Central



ERM-North Central, Inc.

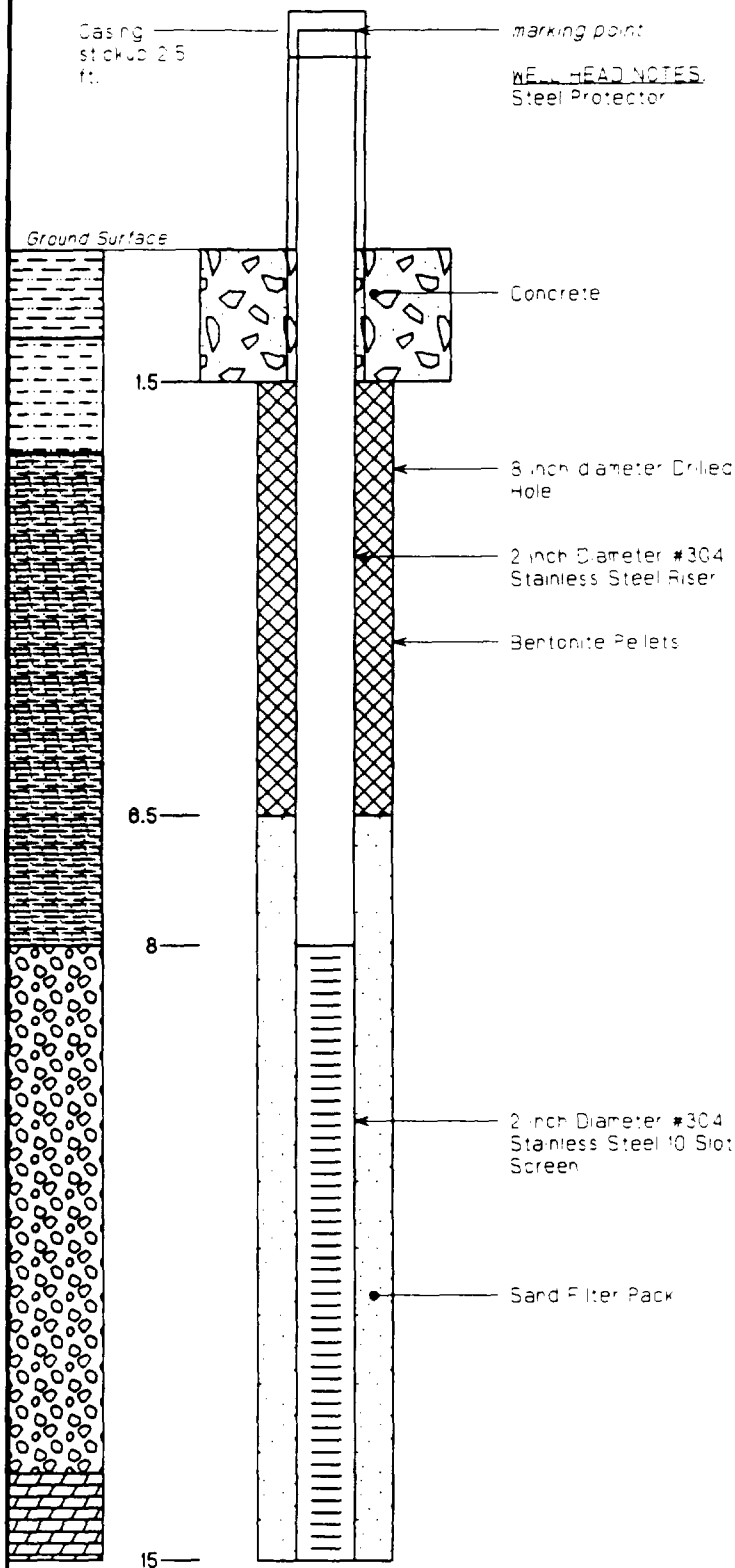
Environmental Resources Management

WELL CONSTRUCTION LOG

PROJECT/TASK
LNAL INVESTIGATION

PROJECT NUMBER
3407EN

WELL NUMBER
P-14



Associated Soil Boring P-14

City Lemont

County and State DuPage, Illinois

Ground Surface Elevation 500.9 AMSL

Measuring Point Elevation 503.69

☒ Surveyed ☐ Estimated

Installation Date (s) 8-1-94

Drilling Method Acker Soil Max. 4-1/4 I.D. HS4

Drilling Contractor Rock & Soil

Drilling Fluid _____

Development Technique (s) / Dates

Bailer - 8/10/94

Fluid Loss During Drilling (gals) _____

Water Removed During Development (gals)

4 8/10/94

Static Water Level Depth (feet) 12.69

Date Water Level Measured 9/16/94

Well Purpose LNAL Investigation

Remarks Strong petroleum odor

Sheen on water

Free product was bailed

Prepared By Dean Jacobsen

Location ERM-North Centre



ERM-North Central, Inc.

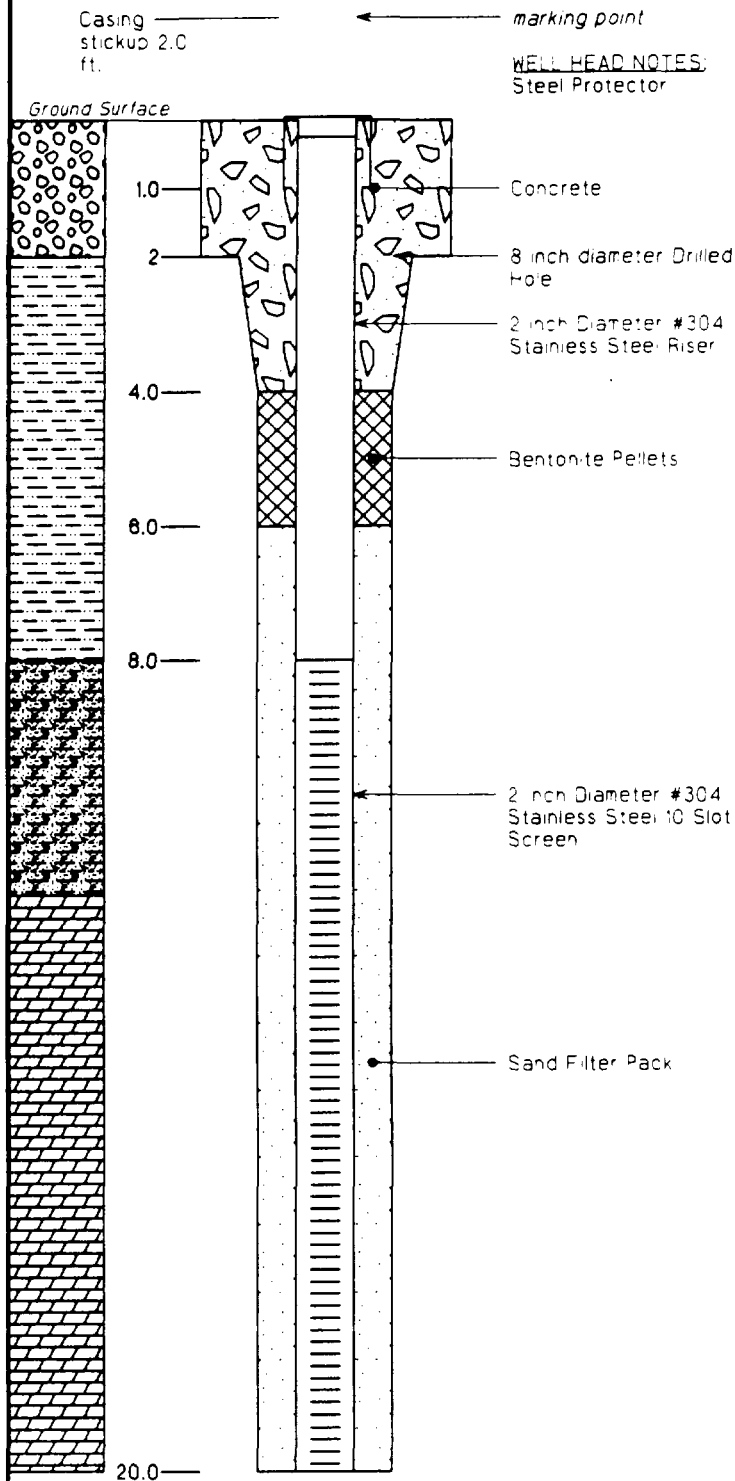
Environmental Resources Management

WELL CONSTRUCTION LOG

PROJECT/TASK
LNAPL INVESTIGATION

PROJECT NUMBER
9401TEM

WELL NUMBER
P-15



Associated Soil Boring P-16

City Lemont

County and State DuPage, Illinois

Ground Surface Elevation 601.654 AMSL

Measuring Point Elevation 601.34

☒ Surveyed ☐ Estimated

Installation Date (s) 8-8-94

Drilling Method 4-1/4 I.D. HS4161 water Rotary

Drilling Contractor Rock & Soil

Drilling Fluid Water in bedrock

Development Technique (s) / Dates

Bailer 8-10/94

Fluid Loss During Drilling (gals) _____

Water Removed During Development (gals)

15 8/10/94

Static Water Level Depth (feet) 11.23

Date Water Level Measured 9/15/94

Well Purpose LNAPL Investigation

Remarks Sight seen on water

Additional water ~10 gals

less than lost to formation

was pumped during drilling

to check water level of

boring.

Prepared By Dean Jacobsen

Location ERM-North Central

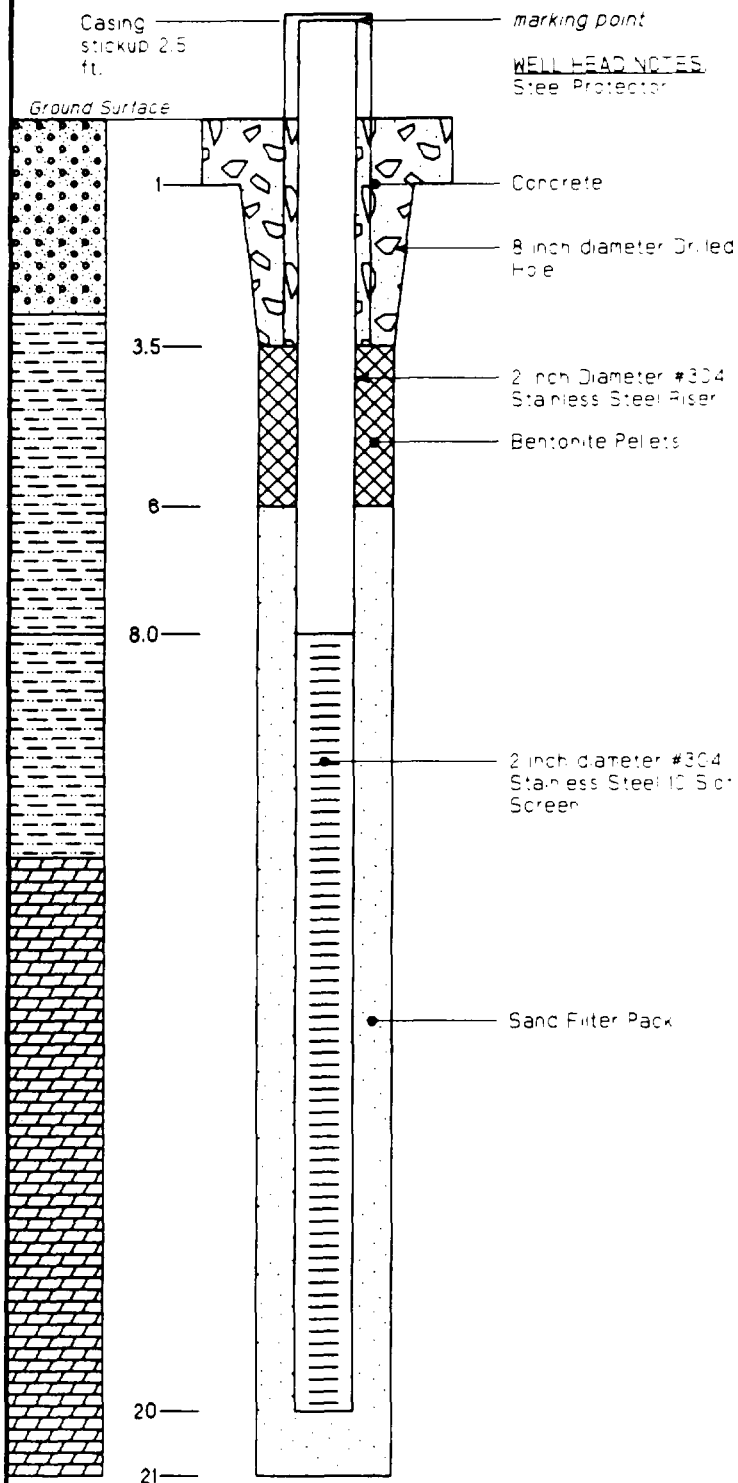


WELL CONSTRUCTION LOG

PROJECT/TASK
LNAPL INVESTIGATION

PROJECT NUMBER
94017EM

WELL NUMBER
P-16



Associated Soil Boring P-10

City Lemont

County and State DePue, Illinois

Ground Surface Elevation 604.7 AMSL

Measuring Point Elevation 604.20

☒ Surveyed ☐ Estimated

Installation Date (s) 8-8-94

Drilling Method 4-1/4" ID HSA 1-5/8" Water Rotary

Drilling Contractor Rock & Soil

Drilling Fluid water in bedrock

Development Technique (s) / Dates

Bailer - 8/10/94

Fluid Loss During Drilling (gals) _____

Water Removed During Development (gals)

5 8/10/94

Static Water Level Depth (feet) 12.41

Date Water Level Measured 8-19-94

Well Purpose LNAPL Investigation

Remarks Shown on water.

Additional water was pumped

from boring during drilling

equal to that of fluid lost.

Prepared By Dean Jacobson

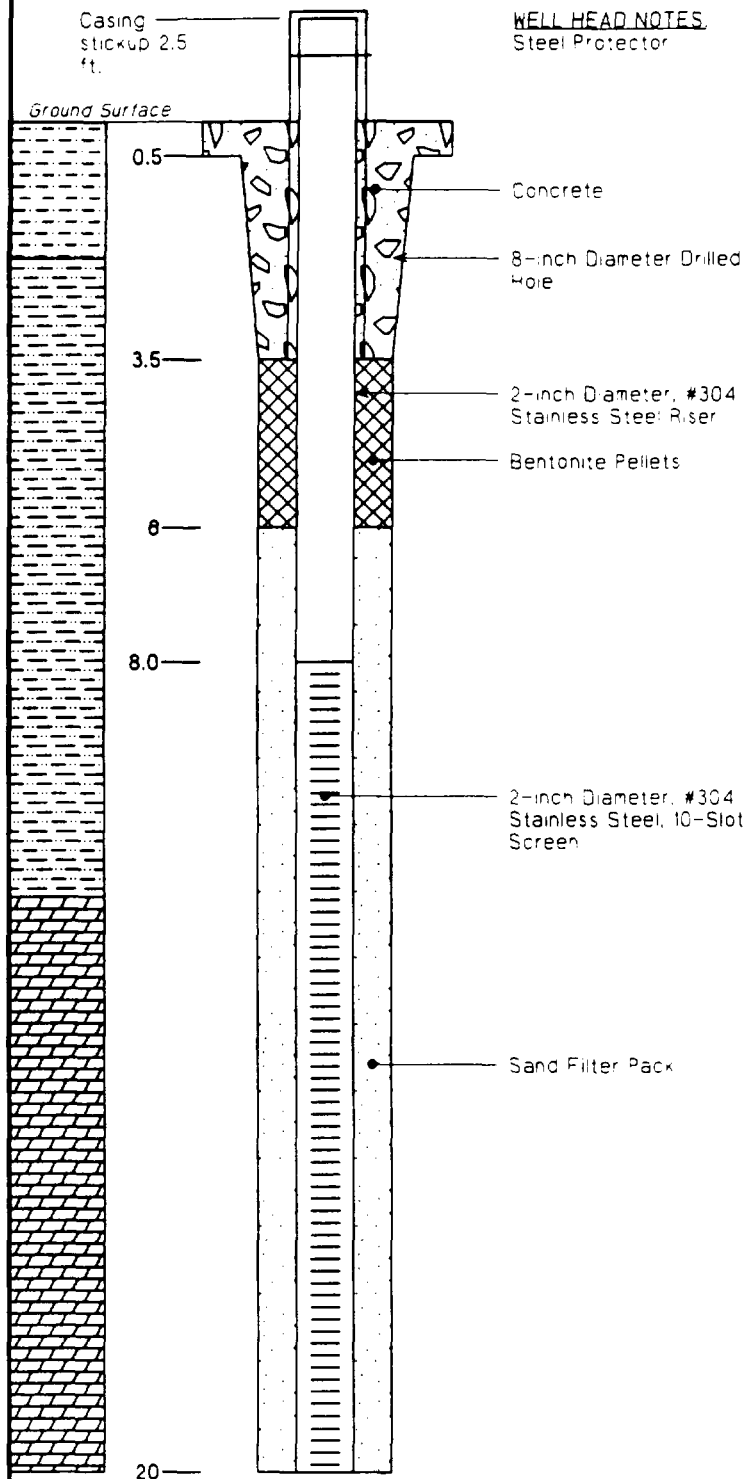
Location ERM-North Central



ERM-North Central, Inc.

Environmental Resources Management

WELL CONSTRUCTION LOG

PROJECT/TASK
LNAPL INVESTIGATIONPROJECT NUMBER
94017EMWELL NUMBER
P-19Associated Soil Boring P-19City LemontCounty and State DuPage, IllinoisGround Surface Elevation 601.3 AMSLMeasuring Point Elevation 604.18☒ Surveyed ☐ EstimatedInstallation Date (s) 8-9-94Drilling Method 4-1/4" I.D. HSA/6" Water RotaryDrilling Contractor Rock & SoilDrilling Fluid Water in bedrock.

Development Technique (s) / Dates

Bailer - 8/12/94Pump - 8/9/94Fluid Loss During Drilling (gals) 40

Water Removed During Development (gals)

44.5 8-12-94Static Water Level Depth (feet) 13.64Date Water Level Measured 8-19-94Well Purpose LNAPL InvestigationRemarks Initial water loss waspumped from boring priorto well construction todetermine the static waterlevel in the boring.Prepared By Dean JacobsonLocation ERM-North Central



ERM-North Central, Inc.

Environmental Resources Management

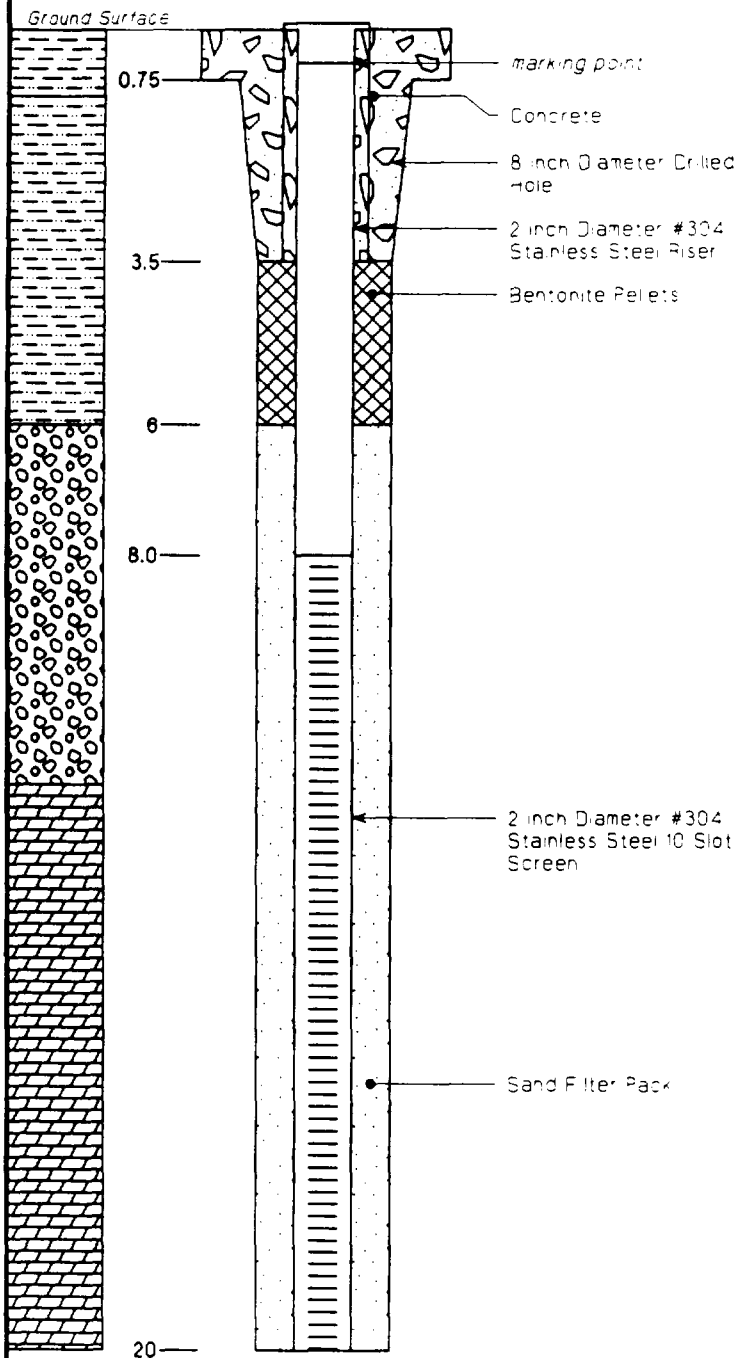
WELL CONSTRUCTION LOG

PROJECT/TASK
LNAPL INVESTIGATION

PROJECT NUMBER
94017EM

WELL NUMBER
P-20

WELL HEAD NOTES: Flush Mount Steel Protector



Associated Soil Boring P-20

City Lemont

County and State DuPage, Illinois

Ground Surface Elevation 599.7 AMSL

Measuring Point Elevation 599.29

☒ Surveyed ☐ Estimated

Installation Date (s) 8-9-94

Drilling Method 4-1/4" I.D. HSA/6" Water Rotary

Drilling Contractor Rock & Soil

Drilling Fluid Water in bedrock.

Development Technique (s) / Dates

Pump - 8/9/94

Bailer - 8/12/94

Fluid Loss During Drilling (gals) 30

Water Removed During Development (gals)

36 8-12-94

Static Water Level Depth (feet) 8.56

Date Water Level Measured 8-19-94

Well Purpose LNAPL Investigation

Remarks Water loss of 30 gallons

was removed by pump in the

augers during drilling to

confirm static water level.

Prepared By Dean Jacobsen

Location ERM-North Central

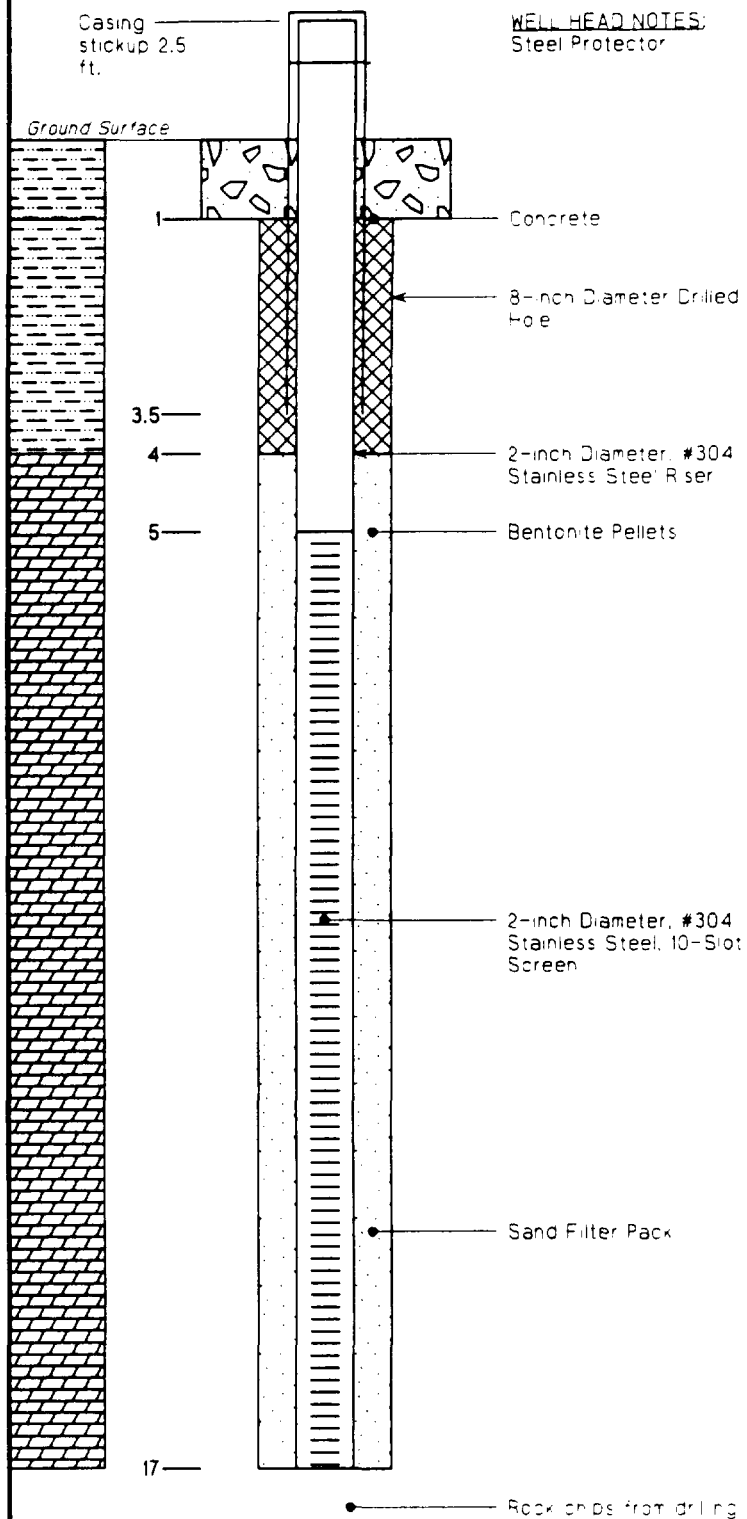


WELL CONSTRUCTION LOG

PROJECT/TASK
LNAPL INVESTIGATION

PROJECT NUMBER
94017EM

WELL NUMBER
P-21



Associated Soil Boring P-21

City Lemont

County and State DuPage, Illinois

Ground Surface Elevation 599.54 MSL

Measuring Point Elevation 601.03

☒ Surveyed ☐ Estimated

Installation Date (s) 8-9-94

Drilling Method 4-1/4" I.D. HSA-6" water Rotary

Drilling Contractor Rock & Soil

Drilling Fluid Water in bedrock

Development Technique (s) / Dates

Bailer - 8/12/94

Fluid Loss During Drilling (gals) _____

Water Removed During Development (gals)

5.1 8-12-94

Static Water Level Depth (feet) 10.63

Date Water Level Measured 8-19-94

Well Purpose LNAPL Investigation

Remarks _____

Prepared By Dean Jacobsen

Location ERM-North Central



ERM-North Central, Inc.
Environmental Resources Management

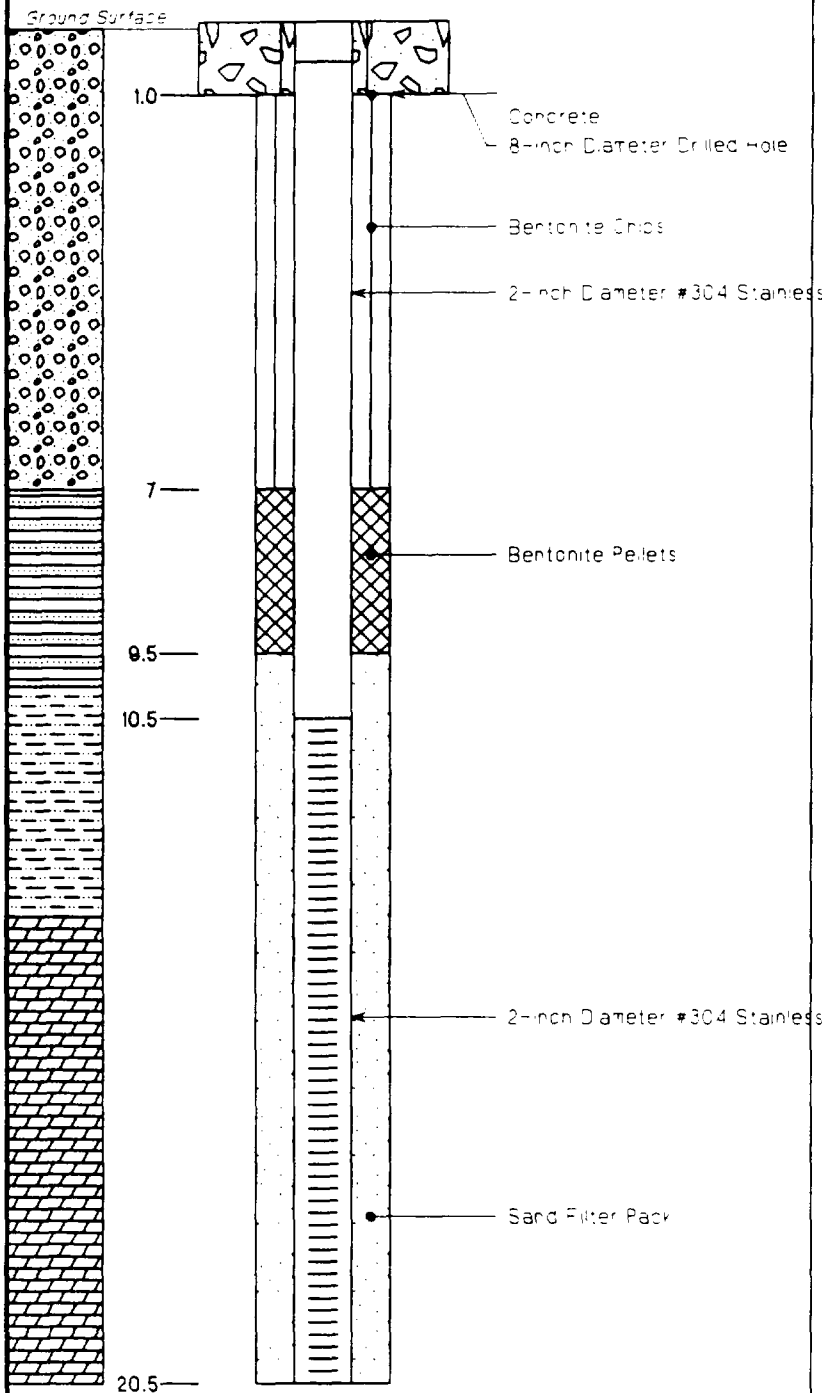
WELL CONSTRUCTION LOG

PROJECT/TASK
LNAPL INVESTIGATION

PROJECT NUMBER
94017EM

WELL NUMBER
P-23

WELL HEAD NOTES
Flush Mount Steel Protector



Associated Soil Boring P-23

City Lemont

County and State DuPage, Illinois

Ground Surface Elevation 601.86 AMSL

Measuring Point Elevation 600.87

☒ Surveyed ☐ Estimated

Installation Date (s) 8-12-94

Drilling Method 4-1/4" I.D. HSA

Drilling Contractor Rock & Soil

Drilling Fluid None

Development Technique (s) / Dates

Fluid Loss During Drilling (gals) _____

Water Removed During Development (gals) _____

Static Water Level Depth (feet) _____

Date Water Level Measured _____

Well Purpose LNAPL Investigation

Remarks _____

Prepared By Daniel W. Petersen

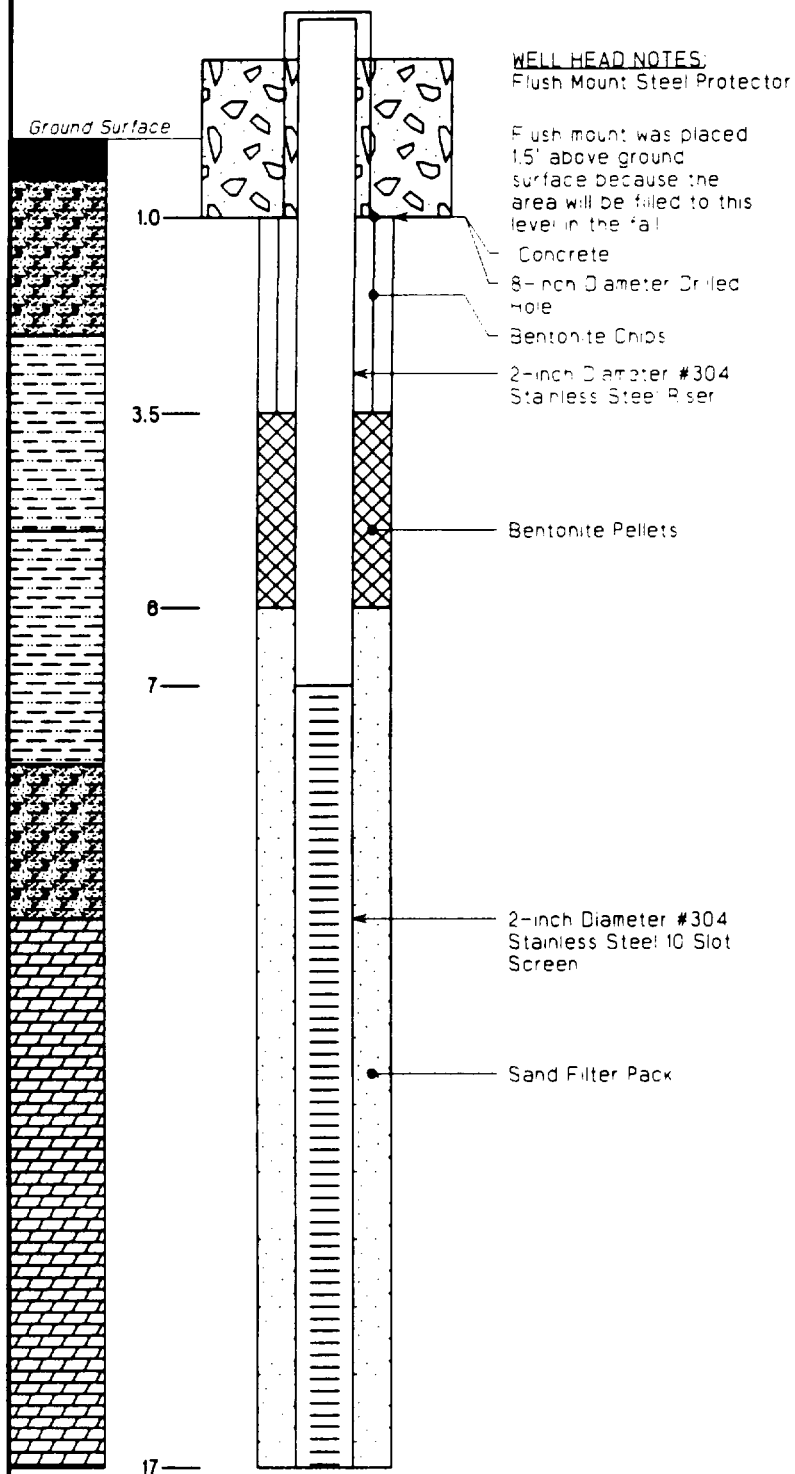
Location ERM-North Central

WELL CONSTRUCTION LOG

PROJECT/TASK
LNAPL INVESTIGATION

PROJECT NUMBER	94017EM
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WELL NUMBER
P-24



Associated Soil Boring P-24

City Lemont

County and State DuPage, Illinois

Ground Surface Elevation 595.761 AMSL

Measuring Point Elevation 596.91☒ Surveyed ☐ Estimated

Installation Date (s) 8-12-94

Drilling Method 4-1/4" I.D. HSADrilling Contractor Rock & SonDrilling Fluid None

Development Technique (s) / Dates

Fluid Loss During Drilling (gals) _____

Water Removed During Development (gals)

Static Water Level Depth (feet) _____

Date Water Level Measured _____

Well Purpose LNAPL Investigation

Remarks _____

Prepared By Daniel W. Petersen

Location ERM-North Central



ERM-North Central, Inc.

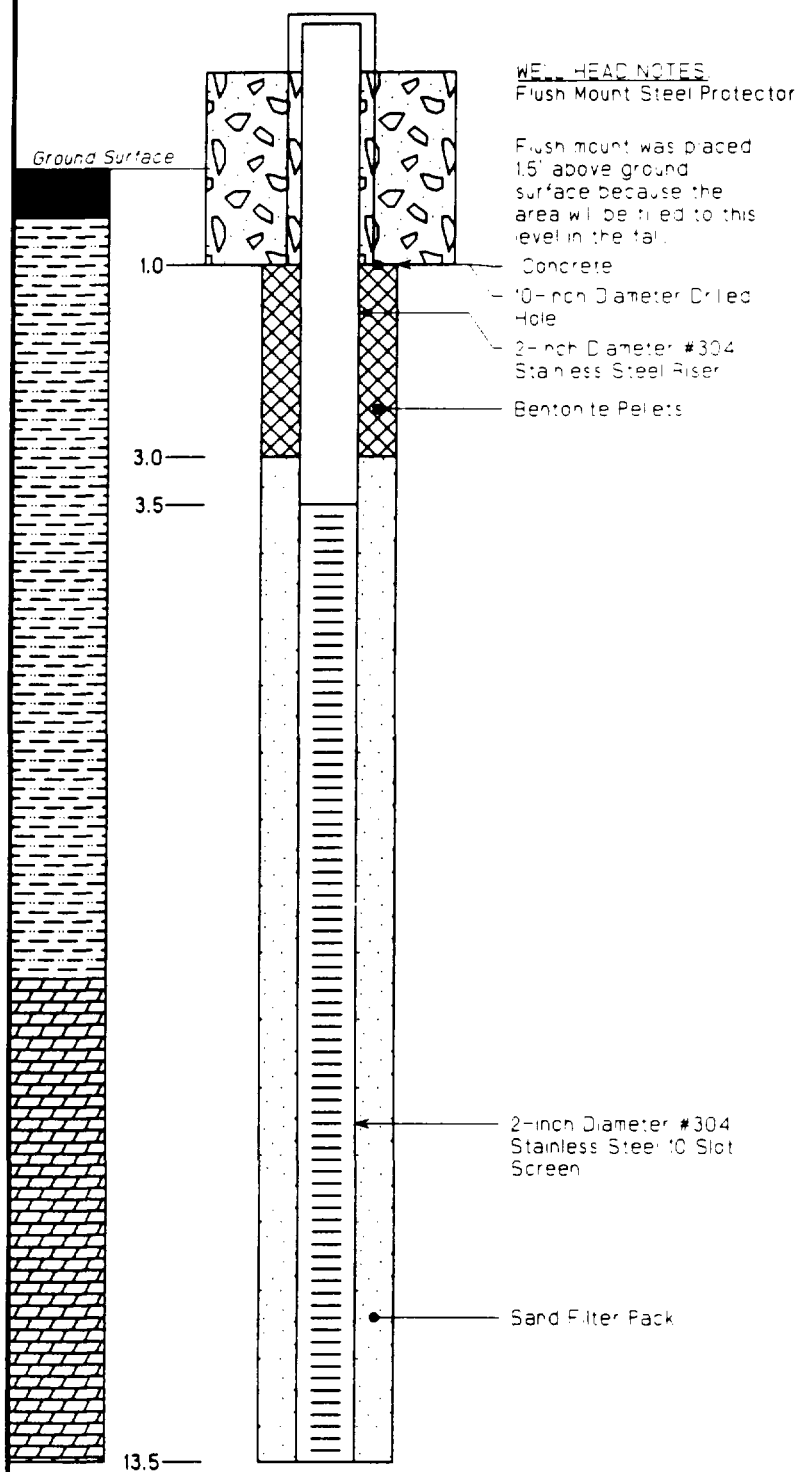
Environmental Resources Management

WELL CONSTRUCTION LOG

PROJECT/TASK
LNAPL INVESTIGATION

PROJECT NUMBER
94017EM

WELL NUMBER
P-24S



Associated Soil Boring P-24S

City Lemont

County and State DuPage, Illinois

Ground Surface Elevation AMSL

Measuring Point Elevation _____

☒ Surveyed ☐ Estimated

Installation Date (s) 10-14-94

Drilling Method 4-1/4" I.D. HSA

Drilling Contractor Rock & Soil

Drilling Fluid None

Development Technique (s) / Dates

Fluid Loss During Drilling (gals) _____

Water Removed During Development (gals)

5 gallons 10/18/94

Static Water Level Depth (feet) _____

Date Water Level Measured _____

Well Purpose LNAPL Investigation

Remarks _____

Prepared By Daniel W. Petersen

Location ERM-North Central



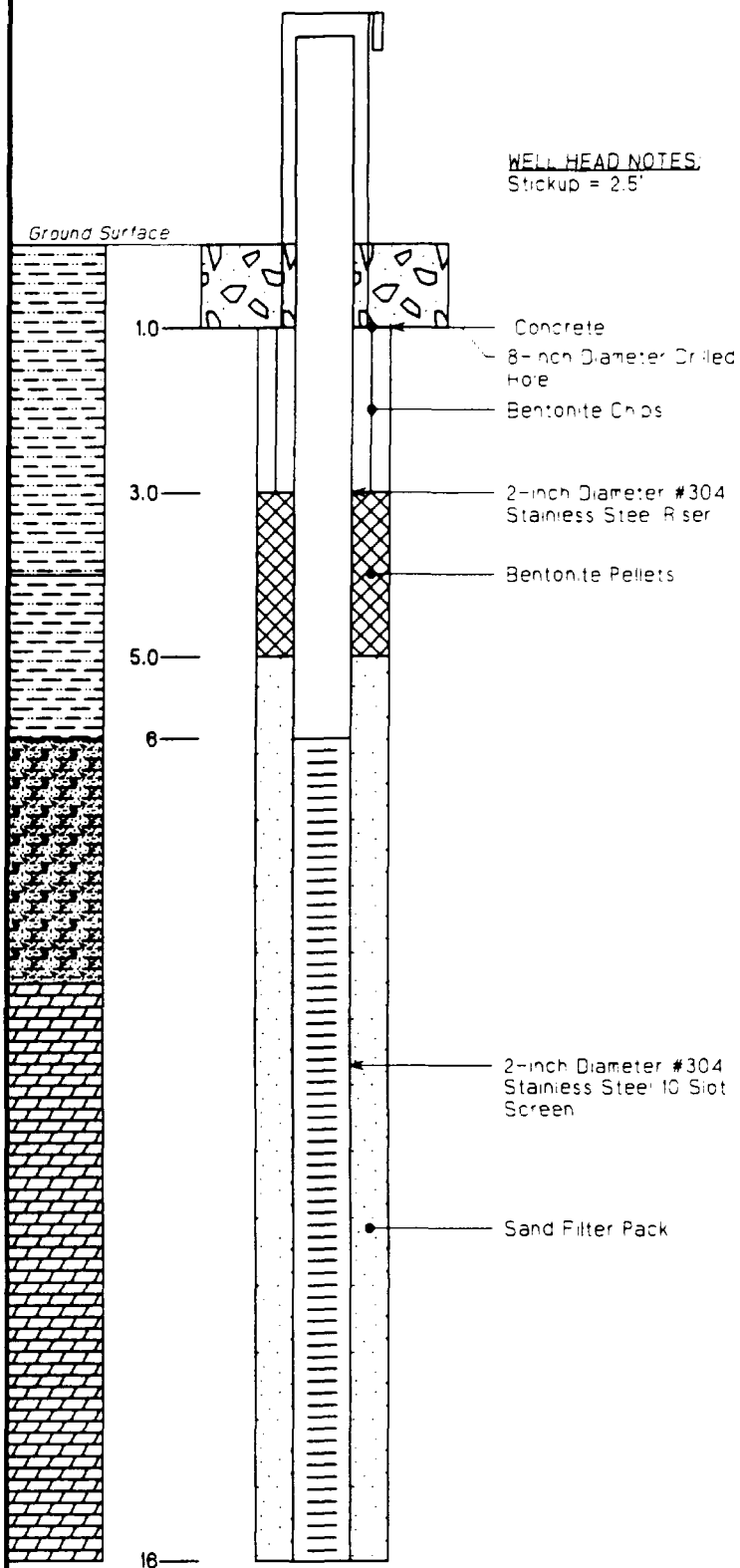
ERM-North Central, Inc.
Environmental Resources Management

WELL CONSTRUCTION LOG

PROJECT/TASK
LNAPL INVESTIGATION

PROJECT NUMBER
94017EM

WELL NUMBER
P-25



Associated Soil Boring P-25

City Lemont

County and State DuPage, Illinois

Ground Surface Elevation 595.662 AMSL

Measuring Point Elevation 597.95

☒ Surveyed ☐ Estimated

Installation Date (s) 9-12-94

Drilling Method 4-1/4" I.D. HSA

Drilling Contractor Rock & Soil

Drilling Fluid None

Development Technique (s) / Dates

Fluid Loss During Drilling (gals)

Water Removed During Development (gals)

Static Water Level Depth (feet)

Date Water Level Measured

Well Purpose LNAPL Investigation

Remarks

Prepared By Daniel W. Petersen

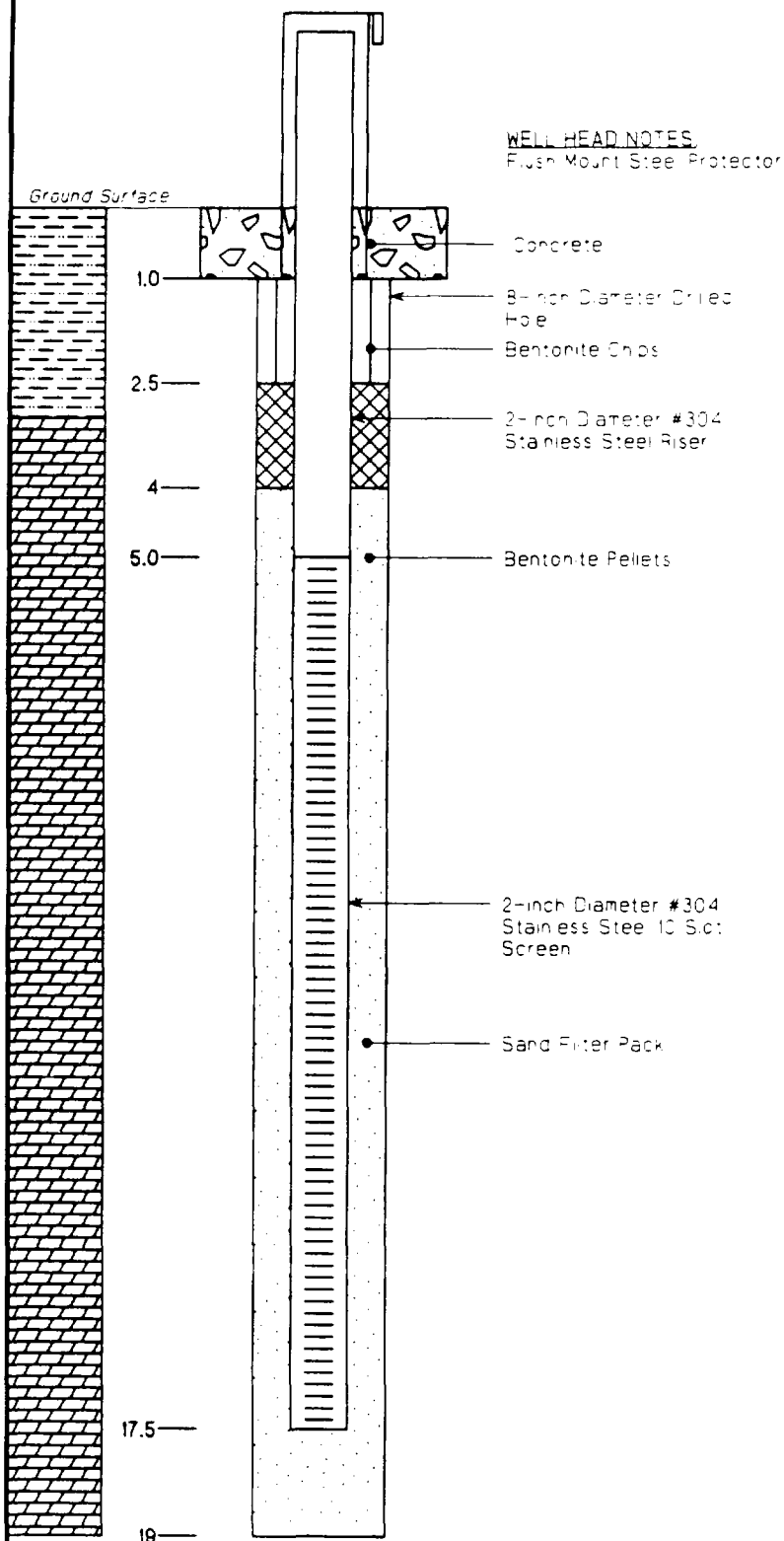
Location ERM-North Central

WELL CONSTRUCTION LOG

PROJECT/TASK	NAP INVESTIGATION
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PROJECT NUMBER
9407EM

WELL NUMBER
P-26

Associated Soil Boring P-20

City Lemont

County and State DuPage, Illinois

Ground Surface Elevation 595.996 AMSL

Measuring Point Elevation 598.23

☒ Surveyed ☐ Estimated

Installation Date (s) 9-12-94

Drilling Method 4-1/4" I.D. HSADrilling Contractor Rock & SoilDrilling Fluid None

Development Technique (s) / Dates

Fluid Loss During Drilling (gals) _____

Water Removed During Development (gals)

Static Water Level Depth (feet) _____

Date Water Level Measured _____

Well Purpose LNAPL Investigation

Remarks _____

Prepared By Daniel W. Petersen

Location EPM-North Central

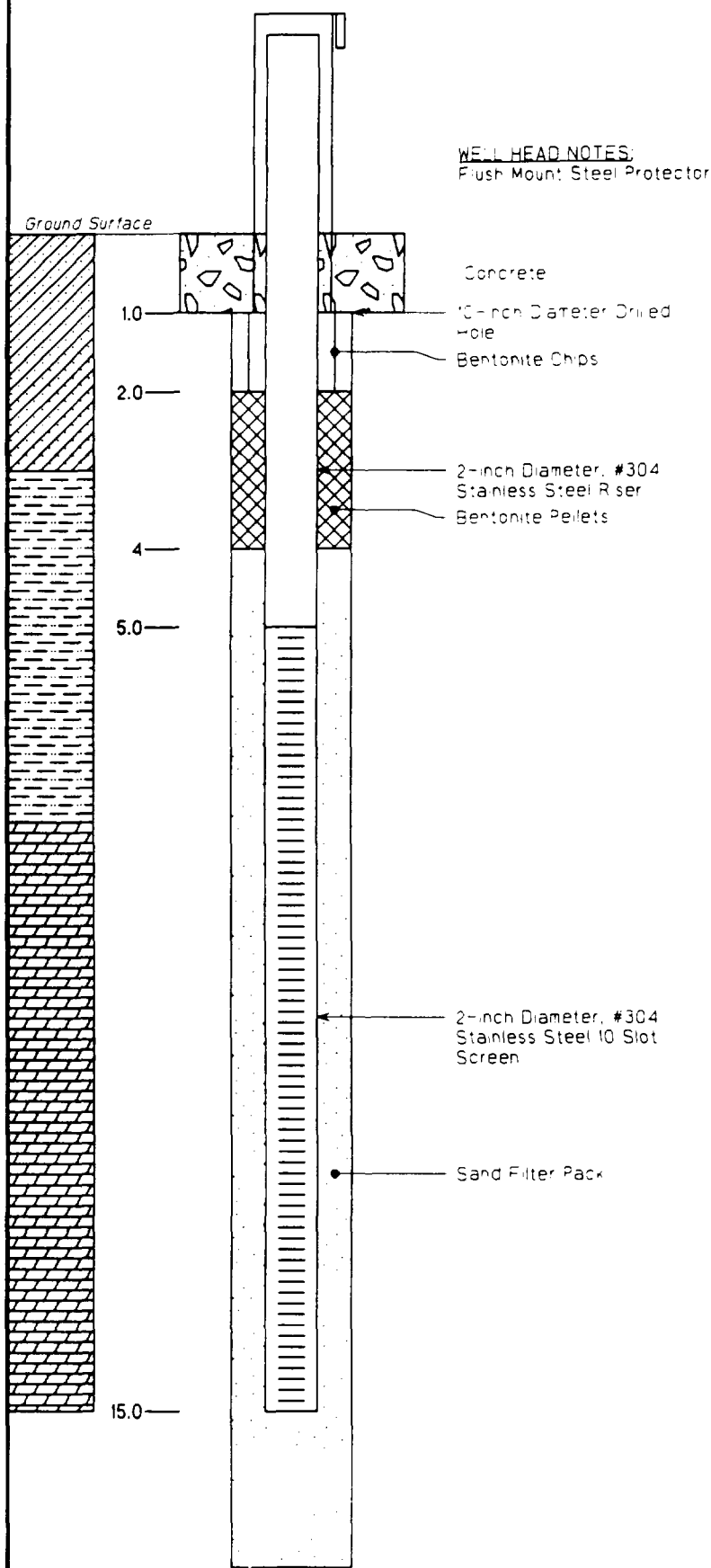


WELL CONSTRUCTION LOG

PROJECT/TASK
LNAPL INVESTIGATION

PROJECT NUMBER
94017EM

WELL NUMBER
G102S



Associated Soil Boring G102S

City Lemont

County and State DuPage, Illinois

Ground Surface Elevation 4MSL

Measuring Point Elevation _____

☒ Surveyed ☐ Estimated

Installation Date (s) 10-14-94

Drilling Method 4-1/4" I.D. HSA

Drilling Contractor Rock & Soil

Drilling Fluid None

Development Technique (s) / Dates

Disposable bailer

Fluid Loss During Drilling (gals) _____

Water Removed During Development (gals)

5 10/18/94

Static Water Level Depth (feet) _____

Date Water Level Measured _____

Well Purpose LNAPL Investigation

Remarks _____

Prepared By Daniel W. Petersen

Location ERM-North Central

APPENDIX C
SURVEY DATA

Well #	Grid N (ft)	Grid E (ft)	Elev Top Casing	Elev Grade	Elev Top Conc Base	Well Type
PO1	685.067	303.207	603.03	600.300	600.633	Stick Up
PO5	726.172	380.328	602.84	600.093	600.426	Stick Up
PO6 REWRK	759.238	291.570	603.65	600.738	601.071	Stick Up
PO7	705.466	197.289	600.55	598.839	599.172	Stick Up
PO8	622.515	165.867	600.81	598.762	599.095	Stick Up
PO9	640.197	468.274	603.62	600.815	601.148	Stick Up
P13	506.215	371.047	603.78	601.677	602.010	Stick Up
P14	508.604	291.058	603.69	600.940	601.273	Stick Up
P15	472.855	238.410	601.34	601.654	601.654	Flush
P16	484.328	428.583	604.20	601.741	602.074	Stick Up
P19	420.042	339.054	604.18	601.284	601.617	Stick Up
P20	379.455	260.075	599.29	599.677	599.677	Flush
P21	366.625	376.139	601.03	598.493	598.826	Stick Up
P23	484.717	198.287	600.87	601.186	601.186	Flush
P24 REWRK	303.666	194.745	596.28	595.761	596.62	Flush
p24S	302.916	198.725	596.18	545.41	596.60	Flush
P25	303.055	301.396	597.95	595.662	595.912	Stick Up
P26	310.660	438.855	598.23	595.996	596.246	Stick Up
MW03S	N/A	N/A	598.02	596.44	N/A	Stick Up
G102S	412.09	473.76	601.82	600.46	599.89	Stick Up

Boring

PO2	696.786	317.064	599.833
PO2A	705.638	327.896	599.600
PO3	668.016	306.441	600.551
PO3A	652.555	302.307	600.510
PO4	690.365	289.970	600.127
PO4A	696.643	278.945	599.813
P10	569.992	435.182	601.042
P11	559.651	342.048	601.627
P12A	544.852	254.524	600.646
P12B	556.658	251.213	600.363
P12C	570.263	248.785	600.686
P17	482.013	511.004	601.868
P18	413.939	200.847	601.159
P22	508.250	471.652	601.430

APPENDIX D
WELL DEVELOPMENT FORMS

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM

SAMPLE I.D.: P-01 DATE: 8/8/94 TIME: 1300

SAMPLERS:	AFFILIATION:	OBSERVERS:	AFFILIATION:
<u>RLP</u>	<u></u>	<u></u>	<u></u>
<u></u>	<u></u>	<u></u>	<u></u>
<u></u>	<u></u>	<u></u>	<u></u>

WELL NUMBER: P-01 TOTAL DEPTH: 18 (ft) I.D.: 2 (in)

MATERIAL: SS #304 SCREENED INTERVAL: - (ft)

WATER LEVEL TO TOP OF CASING (ft)

9.43

PRE-PURGE: POST-PURGE: SAMPLING:

THICKNESS OF WATER COLUMN: 8.57 (ft) CASING VOLUME: 1.39 (gal)

PURGING METHOD: Bailer SAMPLING METHOD:

STABILIZATION TEST

Time	pH	Conductance (umhos/sq cm)	Temperature (deg F)	Cumulative Volume (gal)
<u>1300</u>	<u>7.45</u>	<u>1850</u>	<u>15.0</u>	<u>0</u>
<u>1305</u>	<u>7.35</u>	<u>1800</u>	<u>14.0</u>	<u>1.5</u>
<u>1310</u>	<u>7.35</u>	<u>1600</u>	<u>14.0</u>	<u>3.0</u>
<u>1315</u>	<u>7.35</u>	<u>1650</u>	<u>14.0</u>	<u>4.5</u>

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM

SAMPLE I.D.: P-5 DATE: 8/8/94 TIME: 10:00

SAMPLERS:	AFFILIATION:	OBSERVERS:	AFFILIATION:
<u>RLP</u>	<u>ERM</u>	<u>Mitch Balek</u>	<u>B & V</u>
_____	_____	_____	_____
_____	_____	_____	_____

WELL NUMBER: P-5 TOTAL DEPTH: 14.5 (ft) I.D.: _____ (in)

MATERIAL: SS #304 SCREENED INTERVAL: _____ (ft)

WATER LEVEL TO TOP OF CASING (ft)

10.4

PRE-PURGE: _____ POST-PURGE: _____ SAMPLING: _____

THICKNESS OF WATER COLUMN: 4.1 (ft) CASING VOLUME: 0.67 (gal)

PURGING METHOD: Bailer SAMPLING METHOD: _____

STABILIZATION TEST

Time	pH	Conductance (umhos/sq cm)	Temperature (deg F)	Cumulative Volume (gal)
<u>10:00</u>	<u>7.95</u>	<u>1450</u>	<u>14</u>	<u>0</u>
<u>10:02</u>	<u>7.75</u>	<u>1400</u>	<u>14</u>	<u>0.6</u>
<u>10:04</u>	<u>7.65</u>	<u>1600</u>	<u>13</u>	<u>1.2</u>
<u>10:06</u>	<u>7.65</u>	<u>1600</u>	<u>13</u>	<u>1.8</u>
<u>10:08</u>	<u>7.60</u>	<u>1600</u>	<u>13</u>	<u>2.3</u>

Note: Water chocolate brown

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM

SAMPLE I.D.: P-06 DATE: 8/8/94 TIME: 10:35

SAMPLERS:	AFFILIATION:	OBSERVERS:	AFFILIATION:
<u>RLP</u>	<u></u>	<u></u>	<u></u>
<u></u>	<u></u>	<u></u>	<u></u>
<u></u>	<u></u>	<u></u>	<u></u>

WELL NUMBER: P-06 TOTAL DEPTH: 11.5 (ft) I.D.: 2 (in)

MATERIAL: SS #304 SCREENED INTERVAL: - (ft)

WATER LEVEL TO TOP OF CASING (ft)

10.65

PRE-PURGE: POST-PURGE: SAMPLING:

THICKNESS OF WATER COLUMN: 0.85 (ft) CASING VOLUME: 0.13 (gal)

PURGING METHOD: Bailer SAMPLING METHOD:

STABILIZATION TEST

Time	pH	Conductance (umhos/sq cm)	Temperature (deg F) C	Cumulative Volume (gal)
<u>1035</u>	<u>7.5</u>	<u>3,100</u>	<u>14.5</u>	<u>0.0</u>
<u>1045</u>	<u>7.45</u>	<u>3,050</u>	<u>14.5</u>	<u>0.1</u>
<u>1050</u>	<u>7.40</u>	<u>3,050</u>	<u>14.5</u>	<u>0.2</u>
<u>1052</u>	<u>7.40</u>	<u>3,050</u>	<u>14.5</u>	<u>0.3</u>
<u>1055</u>	<u>7.40</u>	<u>3,050</u>	<u>14.5</u>	<u>0.4</u>

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM

SAMPLE I.D.: P-07 DATE: 8/8/94 TIME: 13:40

SAMPLERS:	AFFILIATION:	OBSERVERS:	AFFILIATION:
<u>RLP</u>	<u>ERM</u>	<u>MITCH BALEK</u>	<u>B&V</u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>

WELL NUMBER: P-07 TOTAL DEPTH: 17 (ft) I.D.: 2 (in)

MATERIAL: SS #304 SCREENED INTERVAL: - (ft)

WATER LEVEL TO TOP OF CASING (ft)

8.6

PRE-PURGE: POST-PURGE: SAMPLING:

THICKNESS OF WATER COLUMN: 8.4 (ft) CASING VOLUME: 1.37 (gal)

PURGING METHOD: SAMPLING METHOD:

STABILIZATION TEST

Time	pH	Conductance (umhos/sq cm)	Temperature (deg <u>F</u>)	Cumulative Volume (gal)
<u>13:40</u>	<u>7.60</u>	<u>1950</u>	<u>16</u>	<u>0</u>
<u>13:45</u>	<u>7.50</u>	<u>1750</u>	<u>15.5</u>	<u>1.5</u>
<u>13:50</u>	<u>7.55</u>	<u>1,600</u>	<u>15.5</u>	<u>3.0</u>
<u>13:55</u>	<u>7.55</u>	<u>1,600</u>	<u>15.0</u>	<u>4.5</u>

Note: Dark brown with sheen.

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM

SAMPLE I.D.: P-08 DATE: 8/8/94 TIME: 15:05

SAMPLERS:	AFFILIATION:	OBSERVERS:	AFFILIATION:
<u>RLP</u>	<u>ERM</u>	<u>Mitch Salek</u>	<u>B & V</u>
_____	_____	_____	_____
_____	_____	_____	_____

WELL NUMBER: P-08 TOTAL DEPTH: 12.5 (ft) I.D.: 2 (in)

MATERIAL: SS #304 SCREENED INTERVAL: - (ft)

WATER LEVEL TO TOP OF CASING (ft)

8.17

PRE-PURGE: POST-PURGE: SAMPLING:

THICKNESS OF WATER COLUMN: 4.33 (ft) CASING VOLUME: .71 (gal)

PURGING METHOD: Bailer SAMPLING METHOD:

STABILIZATION TEST

Time	pH	Conductance (umhos/sq cm)	Temperature (deg F)	Cumulative Volume (gal)
<u>15:05</u>	<u>8.15</u>	<u>1400</u>	<u>16</u>	<u>0</u>
<u>15:10</u>	<u>7.90</u>	<u>1,450</u>	<u>16</u>	<u>1</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

Note: well bailed dry at 2 gallons

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM

SAMPLE I.D.: P-09 DATE: 8/8/94 TIME: 09:00

SAMPLERS:	AFFILIATION:	OBSERVERS:	AFFILIATION:
<u>RLP</u>	<u>ERM</u>	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

WELL NUMBER: P-09 TOTAL DEPTH: 17.8 (ft) I.D.: 2 (in)

MATERIAL: SS #304 SCREENED INTERVAL: _____ (ft)

WATER LEVEL TO TOP OF CASING (ft)

11.47

PRE-PURGE: _____ POST-PURGE: _____ SAMPLING: _____

THICKNESS OF WATER COLUMN: 6.33 (ft) CASING VOLUME: 1 (gal)

PURGING METHOD: Bailer SAMPLING METHOD: _____

STABILIZATION TEST

Time	pH	Conductance (umhos/sq cm)	Temperature (deg F) C	Cumulative Volume (gal)
<u>09:00</u>	<u>7.55</u>	<u>11,200</u>	<u>13.5</u>	<u>0</u>
<u>09:05</u>	<u>7.65</u>	<u>10,000</u>	<u>13.5</u>	<u>1.2</u>
<u>09:08</u>	<u>7.68</u>	<u>10,000</u>	<u>13.0</u>	<u>2.0</u>
<u>09:13</u>	<u>7.68</u>	<u>10,000</u>	<u>13.0</u>	<u>3.0</u>
<u>09:20</u>	<u>7.66</u>	<u>10,000</u>	<u>13.0</u>	<u>4.0</u>

Notes: Slight Sheen ~ odor

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM

SAMPLE I.D.: P-13 DATE: 8/10/94 TIME: 10:05

SAMPLERS:	AFFILIATION:	OBSERVERS:	AFFILIATION:
<u>Dwpz</u>	<u>ERM</u>	<u>Mitch Bales</u>	<u>B&U</u>
_____	_____	_____	_____
_____	_____	_____	_____

WELL NUMBER: P-13 TOTAL DEPTH: 14.1 (ft) I.D.: 2 (in)

MATERIAL: SS #304 SCREENED INTERVAL: - (ft)

WATER LEVEL TO TOP OF CASING (ft)

12.14

PRE-PURGE: _____ POST-PURGE: _____ SAMPLING: _____

THICKNESS OF WATER COLUMN: 2.04 (ft) CASING VOLUME: .33 (gal)

PURGING METHOD: Bailer SAMPLING METHOD: _____

STABILIZATION TEST

Time	pH	Conductance (umhos/sq cm)	Temperature (deg F) C	Cumulative Volume (gal)
<u>10:05</u>	<u>7.45</u>	<u>900</u>	<u>18.0</u>	<u>0</u>
<u>10:10</u>	<u>7.30</u>	<u>750</u>	<u>16.0</u>	<u>0.5</u>
<u>10:16</u>	<u>7.30</u>	<u>750</u>	<u>16.5</u>	<u>1</u>
<u>10:20</u>	<u>7.35</u>	<u>780</u>	<u>16.0</u>	<u>1.5</u>

Note: Sheen on water

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM

SAMPLE I.D.: P-14 DATE: 8/10/94 TIME: 10:45

SAMPLERS:	AFFILIATION:	OBSERVERS:	AFFILIATION:
<u>DWP²</u>	<u>ERM</u>	<u>Mitch Belek</u>	<u>B & V</u>
_____	_____	_____	_____
_____	_____	_____	_____

WELL NUMBER: P-14 TOTAL DEPTH: 18 (ft) I.D.: 2 (in)

MATERIAL: SS #304 SCREENED INTERVAL: - (ft)

WATER LEVEL TO TOP OF CASING (ft)

12.46

PRE-PURGE: POST-PURGE: SAMPLING:

THICKNESS OF WATER COLUMN: 5.5 (ft) CASING VOLUME: .9 (gal)

PURGING METHOD: Bailer SAMPLING METHOD:

STABILIZATION TEST

Time	pH	Conductance (umhos/sq cm)	Temperature (deg F) C	Cumulative Volume (gal)
<u>10:45</u>	<u>7.50</u>	<u>800</u>	<u>18</u>	<u>0</u>
<u>10:51</u>	<u>7.15</u>	<u>900</u>	<u>17</u>	<u>1</u>
<u>10:56</u>	<u>7.20</u>	<u>950</u>	<u>17</u>	<u>2</u>
<u>11:03</u>	<u>7.25</u>	<u>925</u>	<u>17</u>	<u>3</u>
<u>11:08</u>	<u>7.25</u>	<u>900</u>	<u>16.5</u>	<u>4</u>

Note: Strong petroleum odor, sheen on water, free product was bailed.

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM

SAMPLE I.D.: P-15 DATE: 8/10/94 TIME: 8:30

SAMPLERS:	AFFILIATION:	OBSERVERS:	AFFILIATION:
<u>DWP</u>	<u>ERM</u>	<u>mitch Balek</u>	<u>B&V</u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>

WELL NUMBER: P-15 TOTAL DEPTH: 20 (ft) I.D.: 2 (in)

MATERIAL: SS#304 SCREENED INTERVAL: - (ft)

WATER LEVEL TO TOP OF CASING (ft)

10.31

PRE-PURGE: POST-PURGE: SAMPLING:

THICKNESS OF WATER COLUMN: 9.69 (ft) CASING VOLUME: 1.57 (gal)

PURGING METHOD: Bailer SAMPLING METHOD:

STABILIZATION TEST

Time	pH	Conductance (umhos/sq cm)	Temperature (deg F) C	Cumulative Volume (gal)
<u>8:30</u>	<u>8.20</u>	<u>1,000</u>	<u>20</u>	<u>0</u>
<u>8:40</u>	<u>7.80</u>	<u>1,600</u>	<u>16</u>	<u>5</u>
<u>8:50</u>	<u>7.80</u>	<u>1,610</u>	<u>16</u>	<u>10</u>
<u>8:58</u>	<u>7.75</u>	<u>1,600</u>	<u>16</u>	<u>12</u>
<u>9:07</u>	<u>7.75</u>	<u>1,600</u>	<u>16</u>	<u>13</u>
<u>9:12</u>	<u>7.75</u>	<u>1,600</u>	<u>16</u>	<u>15</u>

Notes: Slight sheen on water, 10 gallons purged
because of water loss.

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM

SAMPLE I.D.: P-16 DATE: 8/10/94 TIME: 9:15

SAMPLERS:	AFFILIATION:	OBSERVERS:	AFFILIATION:
<u>DWP²</u>	<u>ERM</u>	<u>MITCH BALEK</u>	<u>B & V</u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>

WELL NUMBER: P-16 TOTAL DEPTH: 21.3 (ft) I.D.: 2 (in)

MATERIAL: SS #304 SCREENED INTERVAL: - (ft)

WATER LEVEL TO TOP OF CASING (ft)

13.24

PRE-PURGE: POST-PURGE: SAMPLING:

THICKNESS OF WATER COLUMN: 8.06 (ft) CASING VOLUME: 1.31 (gal)

PURGING METHOD: Bailer SAMPLING METHOD:

STABILIZATION TEST

Time	pH	Conductance (umhos/sq cm)	Temperature (deg F)	Cumulative Volume (gal)
<u>9:15</u>	<u>7.5</u>	<u>1100</u>	<u>18.5</u>	<u>0</u>
<u>9:18</u>	<u>7.45</u>	<u>1100</u>	<u>16.0</u>	<u>1.25</u>
<u>9:24</u>	<u>7.35</u>	<u>1100</u>	<u>16.0</u>	<u>2.50</u>
<u>9:31</u>	<u>7.40</u>	<u>1100</u>	<u>15.5</u>	<u>3.75</u>
<u>9:35</u>	<u>7.35</u>	<u>1110</u>	<u>15.5</u>	<u>5.0</u>

Notes: Slight sheen on water.

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM

SAMPLE I.D.: P-19 DATE: 8/12/94 TIME: 12:35

SAMPLERS:	AFFILIATION:	OBSERVERS:	AFFILIATION:
<u>RLP</u>	<u>ERM</u>	<u>Mitch Balek</u>	<u>B&V</u>
_____	_____	_____	_____
_____	_____	_____	_____

WELL NUMBER: P-19 TOTAL DEPTH: 23 (ft) I.D.: 2 (in)

MATERIAL: SS #304 SCREENED INTERVAL: - (ft)

WATER LEVEL TO TOP OF CASING (ft)

12.55

PRE-PURGE: POST-PURGE: SAMPLING:

THICKNESS OF WATER COLUMN: 10.45 (ft) CASING VOLUME: 1.7 (gal)

PURGING METHOD: Bailer SAMPLING METHOD:

STABILIZATION TEST

Time	pH	Conductance (umhos/sq cm)	Temperature (deg F)	Cumulative Volume (gal)
<u>12:35</u>	<u>7.98</u>	<u>1,600</u>	<u>15</u>	<u>0</u>
<u>12:45</u>	<u>7.89</u>	<u>1,650</u>	<u>13</u>	<u>1.5</u>
<u>12:50</u>	<u>7.85</u>	<u>1,650</u>	<u>14</u>	<u>3.0</u>
<u>13:00</u>	<u>7.85</u>	<u>1,650</u>	<u>14</u>	<u>4.5</u>

Notes: Strong odor, visible product.

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM

SAMPLE I.D.: P-20 DATE: 8/12/94 TIME: 8:10

SAMPLERS:	AFFILIATION:	OBSERVERS:	AFFILIATION:
<u>RLP</u>	<u>ERM</u>	<u>MITCH BALK</u>	<u>BAV</u>
_____	_____	_____	_____
_____	_____	_____	_____

WELL NUMBER: P-20 TOTAL DEPTH: 20 (ft) I.D.: _____ (in)

MATERIAL: SS 304 SCREENED INTERVAL: _____ (ft)

WATER LEVEL TO TOP OF CASING (ft)

7.7

PRE-PURGE: _____ POST-PURGE: _____ SAMPLING: _____

THICKNESS OF WATER COLUMN: _____ (ft) CASING VOLUME: 2 (gal)

PURGING METHOD: Bailer SAMPLING METHOD: _____

STABILIZATION TEST

Time	pH	Conductance (umhos/sq cm)	Temperature (deg F)	Cumulative Volume (gal)
<u>8:10</u>	<u>8.65</u>	<u>1,050</u>	<u>16.0</u>	<u>0</u>
<u>8:20</u>	<u>8.48</u>	<u>1,100</u>	<u>15.0</u>	<u>2</u>
<u>8:25</u>	<u>8.48</u>	<u>1,100</u>	<u>15.0</u>	<u>4</u>
<u>8:35</u>	<u>8.45</u>	<u>1,100</u>	<u>16.0</u>	<u>6</u>

Note: Visible free product.

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM

SAMPLE I.D.: P-21 DATE: 8/12/94 TIME: 1310

SAMPLERS:	AFFILIATION:	OBSERVERS:	AFFILIATION:
<u>RLP</u>	<u>ERM</u>	<u>Mitch Bolek</u>	<u>Black + Veatch</u>
_____	_____	_____	_____
_____	_____	_____	_____

WELL NUMBER: P-21 TOTAL DEPTH: 17 (ft) I.D.: 2 (in)

MATERIAL: SS #304 SCREENED INTERVAL: - (ft)

WATER LEVEL TO TOP OF CASING (ft)

6.18'

PRE-PURGE: POST-PURGE: SAMPLING:

THICKNESS OF WATER COLUMN: 10.82 (ft) CASING VOLUME: 1.7 (gal)

PURGING METHOD: Bailing SAMPLING METHOD:

STABILIZATION TEST

Time	pH	Conductance (umhos/sq cm)	Temperature (deg F) C	Cumulative Volume (gal)
<u>1310</u>	<u>7.75</u>	<u>800</u>	<u>15</u>	<u>0</u>
<u>1315</u>	<u>7.65</u>	<u>800</u>	<u>15</u>	<u>1.7</u>
<u>1318</u>	<u>7.65</u>	<u>800</u>	<u>15</u>	<u>3.4</u>
<u>1325</u>	<u>7.65</u>	<u>800</u>	<u>15</u>	<u>5.1</u>

Note: Water lost during drilling was removed during drilling to test for water level.

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM

SAMPLE I.D.: P-23 DATE: 9/15/94 TIME: 11:55

SAMPLERS:	AFFILIATION:	OBSERVERS:	AFFILIATION:
<u>RLP</u>	<u>ERM</u>	<u></u>	<u></u>
<u></u>	<u></u>	<u></u>	<u></u>
<u></u>	<u></u>	<u></u>	<u></u>

WELL NUMBER: P-23 TOTAL DEPTH: 18.4 (ft) I.D.: 2 (in)

MATERIAL: SS #304 SCREENED INTERVAL: - (ft)

WATER LEVEL TO TOP OF CASING (ft)

10.27

PRE-PURGE: POST-PURGE: SAMPLING:

THICKNESS OF WATER COLUMN: 8.13 (ft) CASING VOLUME: 1.32 (gal)

PURGING METHOD: Bailer SAMPLING METHOD:

STABILIZATION TEST

Time	pH	Conductance (umhos/sq cm)	Temperature (deg <u>F</u>)	Cumulative Volume (gal)
<u>11:55</u>	<u>8.07</u>	<u>2,300</u>	<u>20</u>	<u>0</u>
<u>11:58</u>	<u>8.05</u>	<u>2,100</u>	<u>19</u>	<u>1.5</u>
<u>12:00</u>	<u>8.23</u>	<u>2,050</u>	<u>19</u>	<u>3.0</u>
<u>12:08</u>	<u>8.24</u>	<u>2,050</u>	<u>19</u>	<u>4.5</u>

Note: Water is milky gray.

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM

SAMPLE I.D.: P-24 DATE: 9/15/94 TIME: 12:35

SAMPLERS:	AFFILIATION:	OBSERVERS:	AFFILIATION:
<u>Russ Pedersen</u>	<u>ERM</u>	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

WELL NUMBER: _____ TOTAL DEPTH: 17.98 (ft) I.D.: 2 (in)

MATERIAL: SS #304 SCREENED INTERVAL: _____ - _____ (ft)

WATER LEVEL TO TOP OF CASING (ft)

7.65

PRE-PURGE: _____ POST-PURGE: _____ SAMPLING: _____

THICKNESS OF WATER COLUMN: 10.33 (ft) CASING VOLUME: 1.68 (gal)

PURGING METHOD: Bailer-Disposable SAMPLING METHOD: _____

STABILIZATION TEST

Time	pH	Conductance (umhos/sq cm)	Temperature (deg F) C	Cumulative Volume (gal)
<u>12:35</u>	<u>8.12</u>	<u>1200</u>	<u>21</u>	<u>0</u>
<u>12:40</u>	<u>8.10</u>	<u>1300</u>	<u>20</u>	<u>1.6</u>
<u>12:45</u>	<u>8.12</u>	<u>1250</u>	<u>20</u>	<u>3.2</u>
<u>12:50</u>	<u>8.12</u>	<u>1250</u>	<u>20</u>	<u>5.8</u>

Water is milky, strong odor, oil accumulated in bucket.

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM

SAMPLE I.D.: P-245 DATE: 0-18-94 TIME: 7:35

SAMPLERS:	AFFILIATION:	OBSERVERS:	AFFILIATION:
<u>Dan Petersen</u>	<u>ERM</u>	<u>Bal Barera</u>	<u>Black & Veatch</u>
_____	_____	_____	_____
_____	_____	_____	_____

WELL NUMBER: P-245 TOTAL DEPTH: 13.5 (ft) I.D.: 2 (in)

MATERIAL: SS #304 SCREENED INTERVAL: 3.5-13.5 (ft)

WATER LEVEL TO TOP OF CASING (ft)

PRE-PURGE: 6.79 POST-PURGE: _____ SAMPLING: _____

THICKNESS OF WATER COLUMN: 6.7 (ft) CASING VOLUME: 1.1 (gal)

PURGING METHOD: Bailer SAMPLING METHOD: _____

STABILIZATION TEST

Time	pH	Conductance (umhos/sq cm)	Temperature (deg F) C	Cumulative Volume (gal)
<u>0</u>	<u>7.63</u>	<u>1590</u>	<u>15.1</u>	_____
<u>1.25</u>	<u>7.63</u>	<u>1350</u>	<u>15.1</u>	_____
<u>2.5</u>	<u>7.56</u>	<u>1240</u>	<u>15.1</u>	_____
<u>3.5</u>	<u>7.49</u>	<u>1200</u>	<u>15.1</u>	_____
<u>4.5</u>	<u>7.49</u>	<u>1200</u>	<u>15.1</u>	_____

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM

SAMPLE I.D.: P-25 DATE: 9/15/94 TIME: 13:10

SAMPLERS:	AFFILIATION:	OBSERVERS:	AFFILIATION:
<u>RLP</u>	<u>ERM</u>	<u></u>	<u></u>
<u></u>	<u></u>	<u></u>	<u></u>
<u></u>	<u></u>	<u></u>	<u></u>

WELL NUMBER: P-25 TOTAL DEPTH: 17.58 (ft) I.D.: 2 (in)

MATERIAL: SS #304 SCREENED INTERVAL: - (ft)

WATER LEVEL TO TOP OF CASING (ft)

8.62

PRE-PURGE: POST-PURGE: SAMPLING:

THICKNESS OF WATER COLUMN: 9.96 (ft) CASING VOLUME: 1.65 (gal)

PURGING METHOD: Bailer SAMPLING METHOD:

STABILIZATION TEST

Time	pH	Conductance (umhos/sq cm)	Temperature (deg $^{\circ}$ C)	Cumulative Volume (gal)
<u>13:10</u>	<u>7.69</u>	<u>1250</u>	<u>20</u>	<u>0</u>
<u>13:12</u>	<u>7.78</u>	<u>1300</u>	<u>20</u>	<u>1.6</u>
<u>13:17</u>	<u>7.80</u>	<u>1300</u>	<u>20</u>	<u>3.2</u>
<u>13:30</u>	<u>7.85</u>	<u>1300</u>	<u>19.5</u>	<u>4.8</u>

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM

SAMPLE I.D.: P-26 DATE: 9/15/94 TIME: 13:45

SAMPLERS:	AFFILIATION:	OBSERVERS:	AFFILIATION:
<u>RLP</u>	<u>ERM</u>	<u></u>	<u></u>
<u></u>	<u></u>	<u></u>	<u></u>
<u></u>	<u></u>	<u></u>	<u></u>

WELL NUMBER: P-26 TOTAL DEPTH: 20.72(ft) I.D.: 2(in)

MATERIAL: SS #304 SCREENED INTERVAL: - (ft)

WATER LEVEL TO TOP OF CASING (ft)

8.65

PRE-PURGE: POST-PURGE: SAMPLING:

THICKNESS OF WATER COLUMN: 12.07(ft) CASING VOLUME: 1.96(gal)

PURGING METHOD: Bailer SAMPLING METHOD:

STABILIZATION TEST

Time	pH	Conductance (umhos/sq cm)	Temperature (deg F)	Cumulative Volume (gal)
<u>13:45</u>	<u>6.36</u>	<u>2100</u>	<u>20.0</u>	<u>0</u>
<u>13:50</u>	<u>6.43</u>	<u>2100</u>	<u>18.0</u>	<u>2</u>
<u>13:58</u>	<u>6.43</u>	<u>2100</u>	<u>18.0</u>	<u>4</u>
<u>14:05</u>	<u>6.43</u>	<u>2100</u>	<u>18.0</u>	<u>6</u>

FIGURE 2-4

LENZ OIL SITE REMEDIAL INVESTIGATION
PROJECT NO: 9292

GROUND WATER SAMPLING
FIELD DATA FORM

SAMPLE I.D.: G102ES DATE: 10-18-94 TIME: 8:30

SAMPLERS:	AFFILIATION:	OBSERVERS:	AFFILIATION:
<u>D. Petersen</u>	<u>ERM</u>	<u>Bal Baren</u>	<u>BSV</u>
_____	_____	_____	_____
_____	_____	_____	_____

WELL NUMBER: G102S TOTAL DEPTH: 17.5 (ft) I.D.: 2 (in)

MATERIAL: SS #304 SCREENED INTERVAL: 7.5 - 12.5 (ft)

WATER LEVEL TO TOP OF CASING (ft)

PRE-PURGE: 12.09 POST-PURGE: _____ SAMPLING: _____

THICKNESS OF WATER COLUMN: 5.4 (ft) CASING VOLUME: _____ (gal)

PURGING METHOD: Bailer SAMPLING METHOD: _____

STABILIZATION TEST

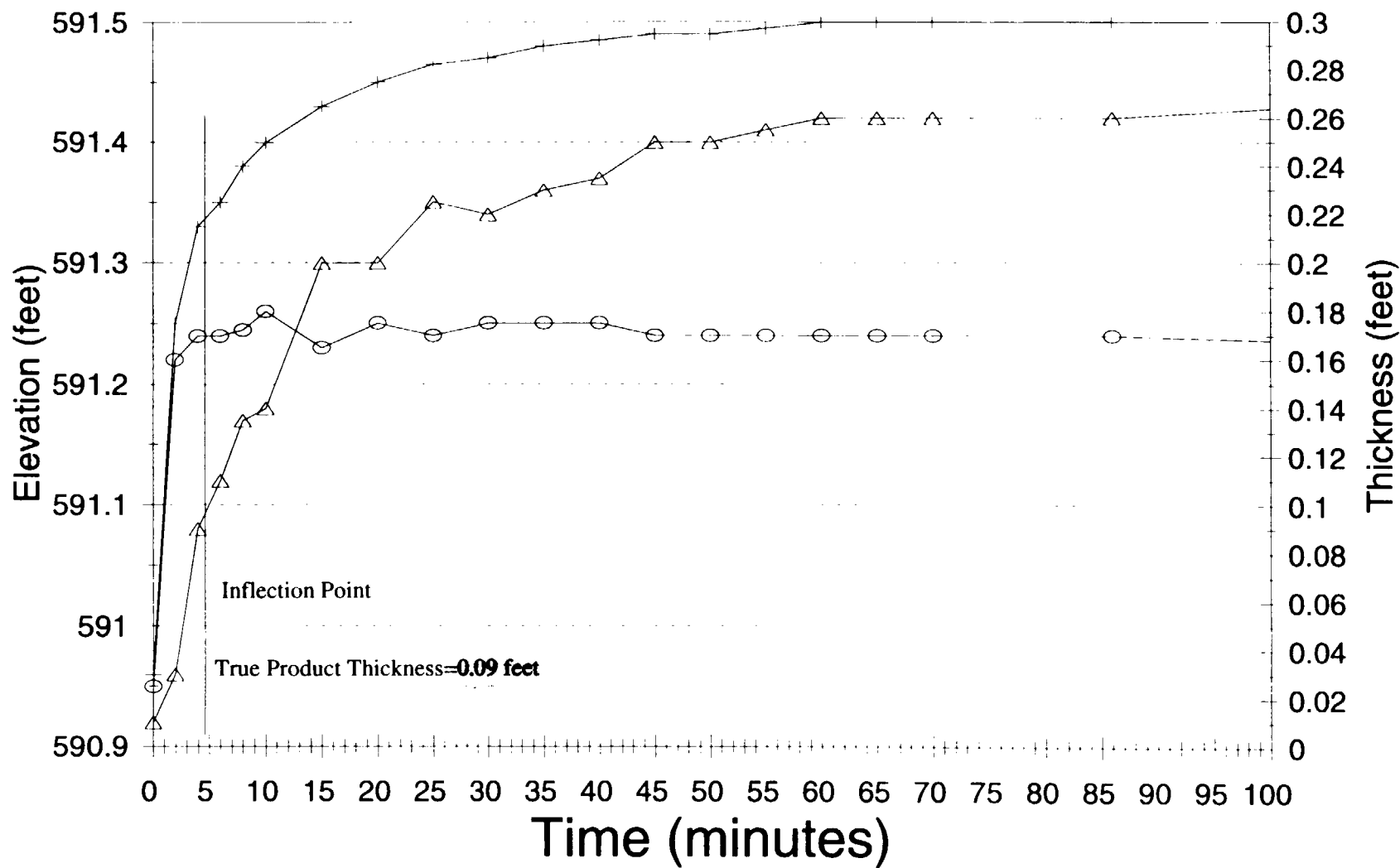
Time	pH	Conductance (umhos/sq cm)	Temperature (deg F)	Cumulative Volume (gal)
<u>0840</u>	<u>7.6</u>	<u>1310</u>	<u>14.8</u>	<u>08</u>
<u>0844</u>	<u>7.59</u>	<u>1310</u>	<u>14.9</u>	<u>1</u>
<u>0847</u>	<u>7.64</u>	<u>1400</u>	<u>14.8</u>	<u>2</u>
<u>0850</u>	<u>7.61</u>	<u>1400</u>	<u>14.7</u>	<u>3</u>
<u>0852</u>	<u>7.59</u>	<u>1400</u>	<u>14.6</u>	<u>4</u>
<u>0854</u>	<u>7.59</u>	<u>1400</u>	<u>14.6</u>	<u>5</u>

APPENDIX E

BAIL-DOWN TEST RESULTS

G106L BAILDOWN TEST

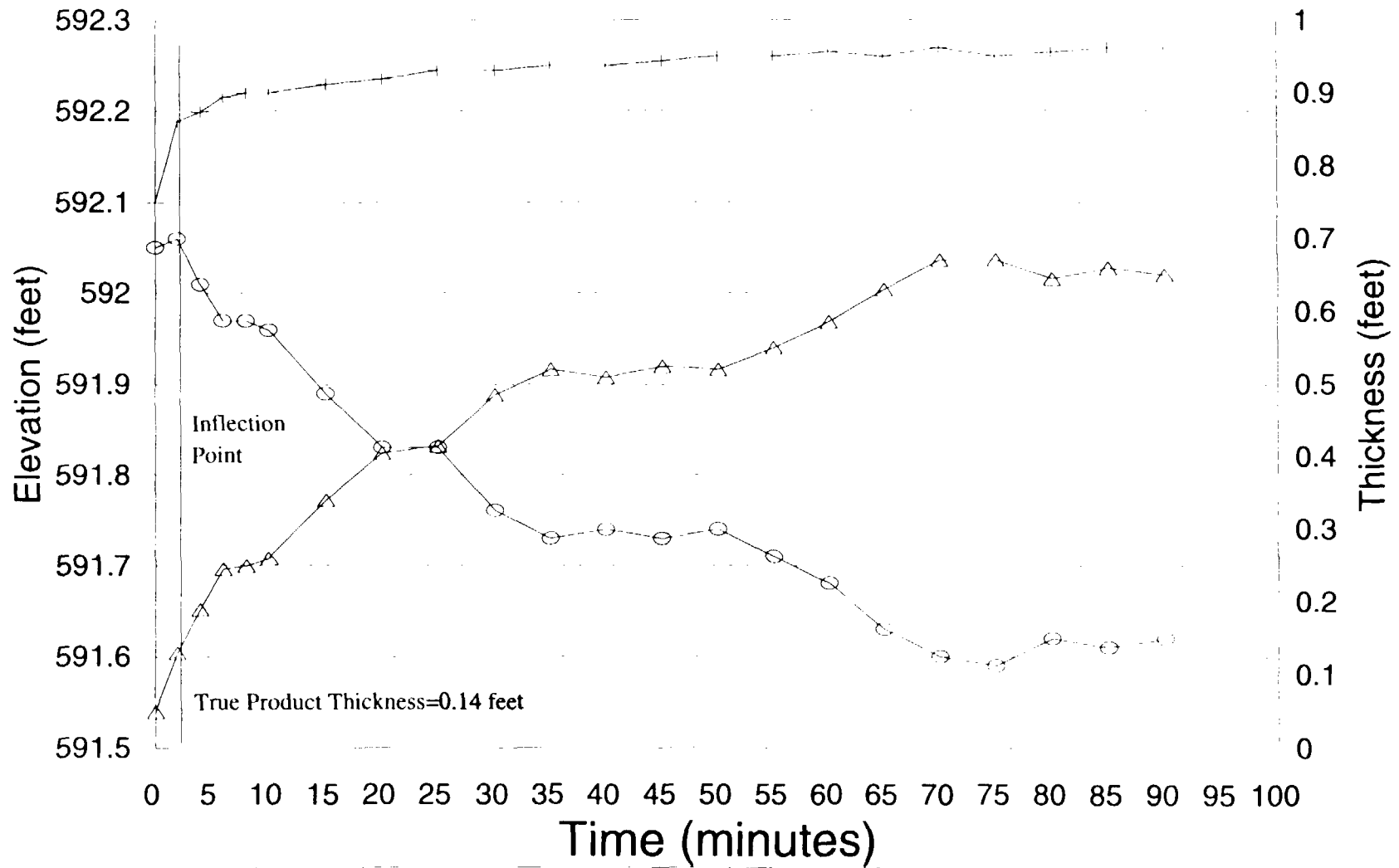
LENZ OIL SITE, LEMONT, ILLINOIS



Oil o Water ^ Oil Thickness

MW-5S BAILDOWN TEST

LENZ OIL SITE, LEMONT, ILLINOIS



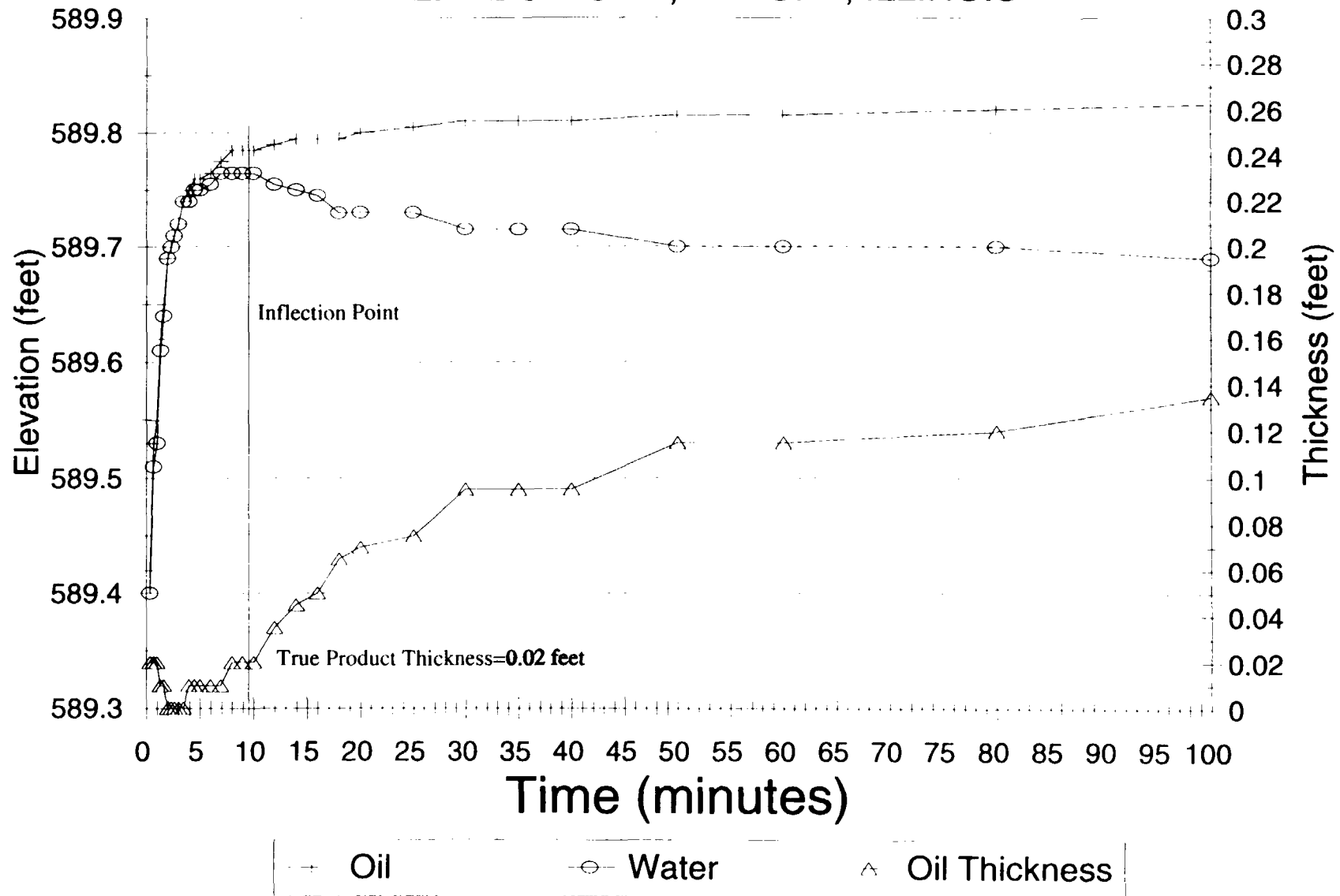
Oil

o Water

^ Oil Thickness

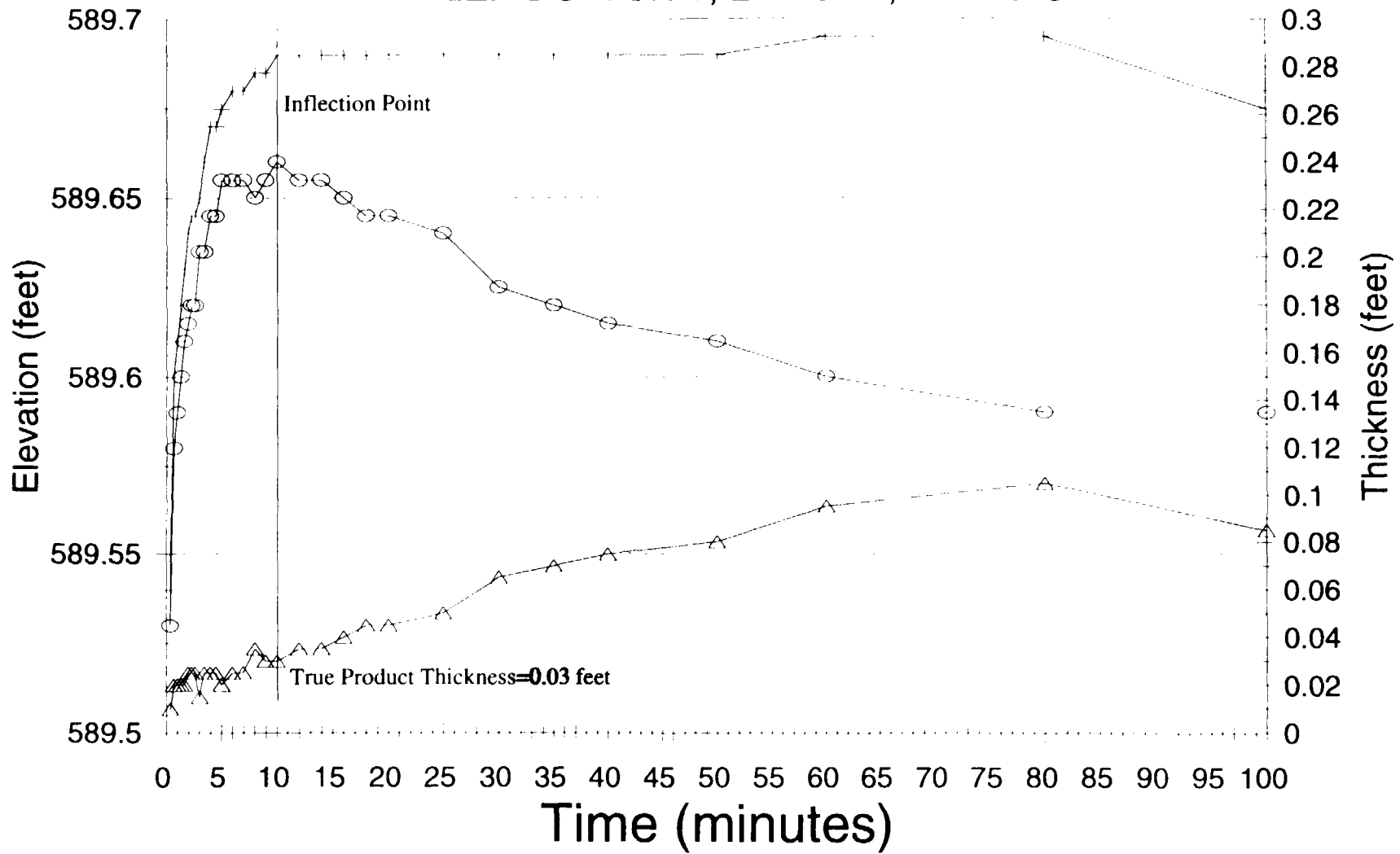
P-19 BAILDOWN TEST

LENZ OIL SITE, LEMONT, ILLINOIS



P-20 BAILDOWN TEST

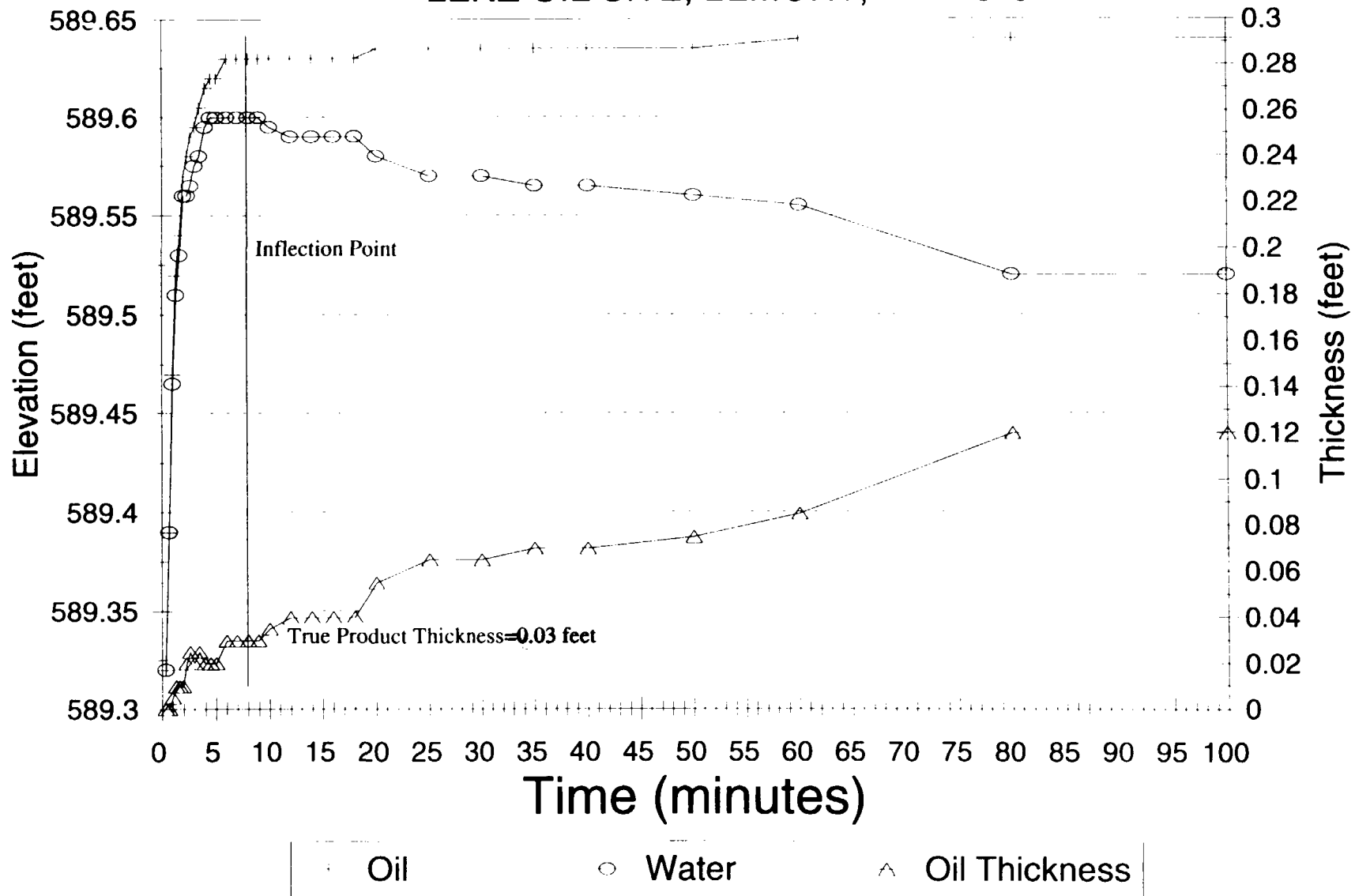
LENZ OIL SITE, LEMONT, ILLINOIS



Oil Water Oil Thickness

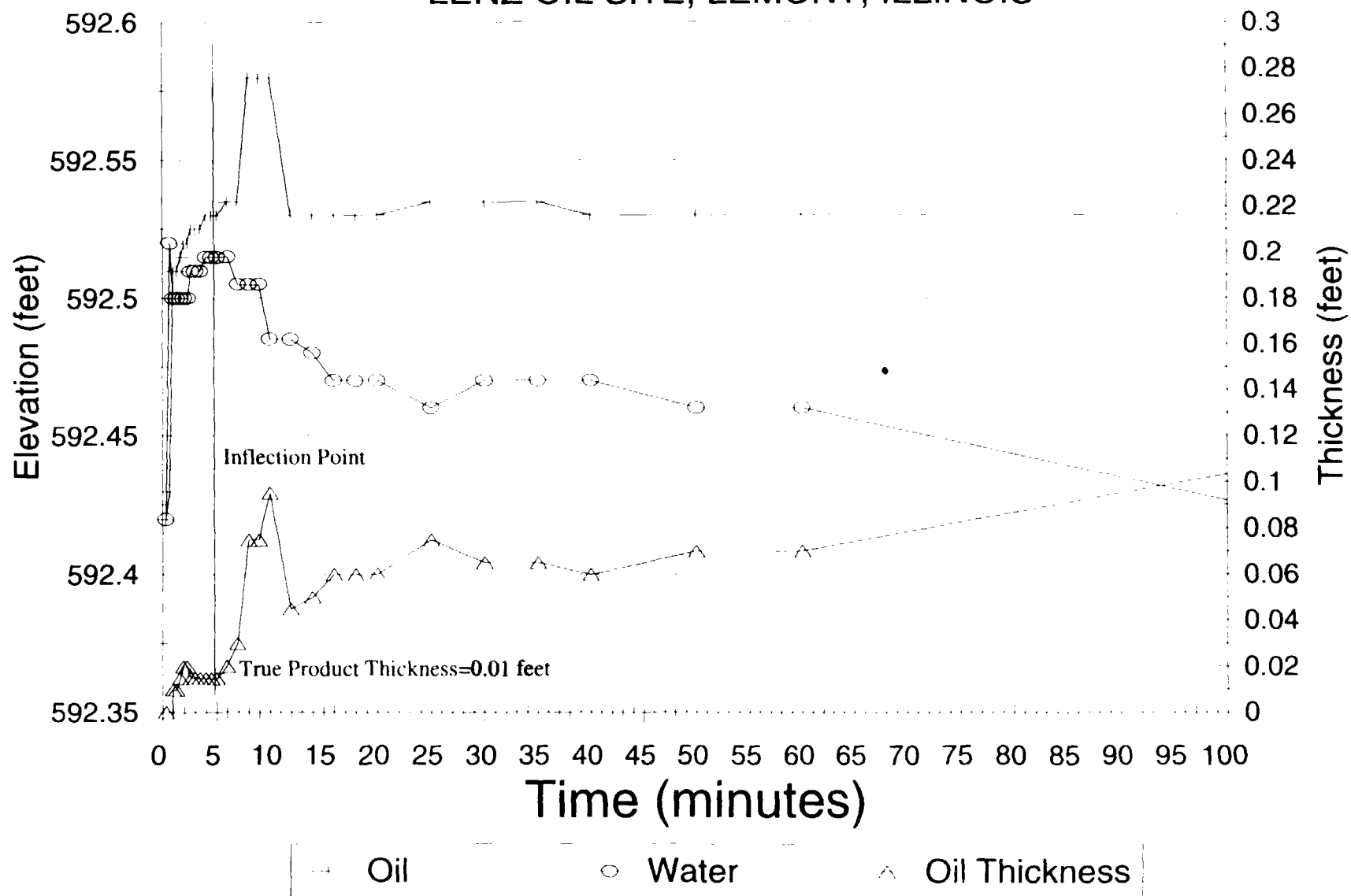
P-21 BAILDOWN TEST

LENZ OIL SITE, LEMONT, ILLINOIS

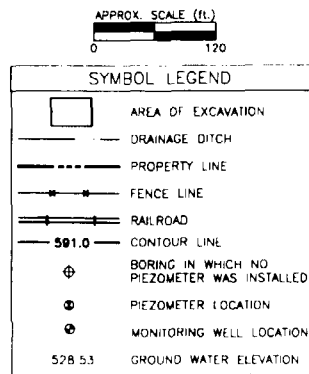


P-1 BAILDOWN TEST

LENZ OIL SITE, LEMONT, ILLINOIS



APPENDIX F
PIEZOMETRIC SURFACE MAPS



NOTES:

THE EXCAVATION BOUNDARIES ARE BASED ON SKETCHES PROVIDED BY THE ILLINOIS ENVIRONMENTAL PROTECTION AGENCY FOR THE REMEDIAL INVESTIGATION REPORT PREPARED BY ERM-NORTH CENTRAL, INC. ACCORDING TO FIELD OBSERVATIONS, PIEZOMETERS P05 AND P07 ARE OUTSIDE THE AREA OF THE MAIN EXCAVATION, AND PIEZOMETER P11 IS INSIDE THE AREA OF THE MAIN EXCAVATION. ALL ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL.

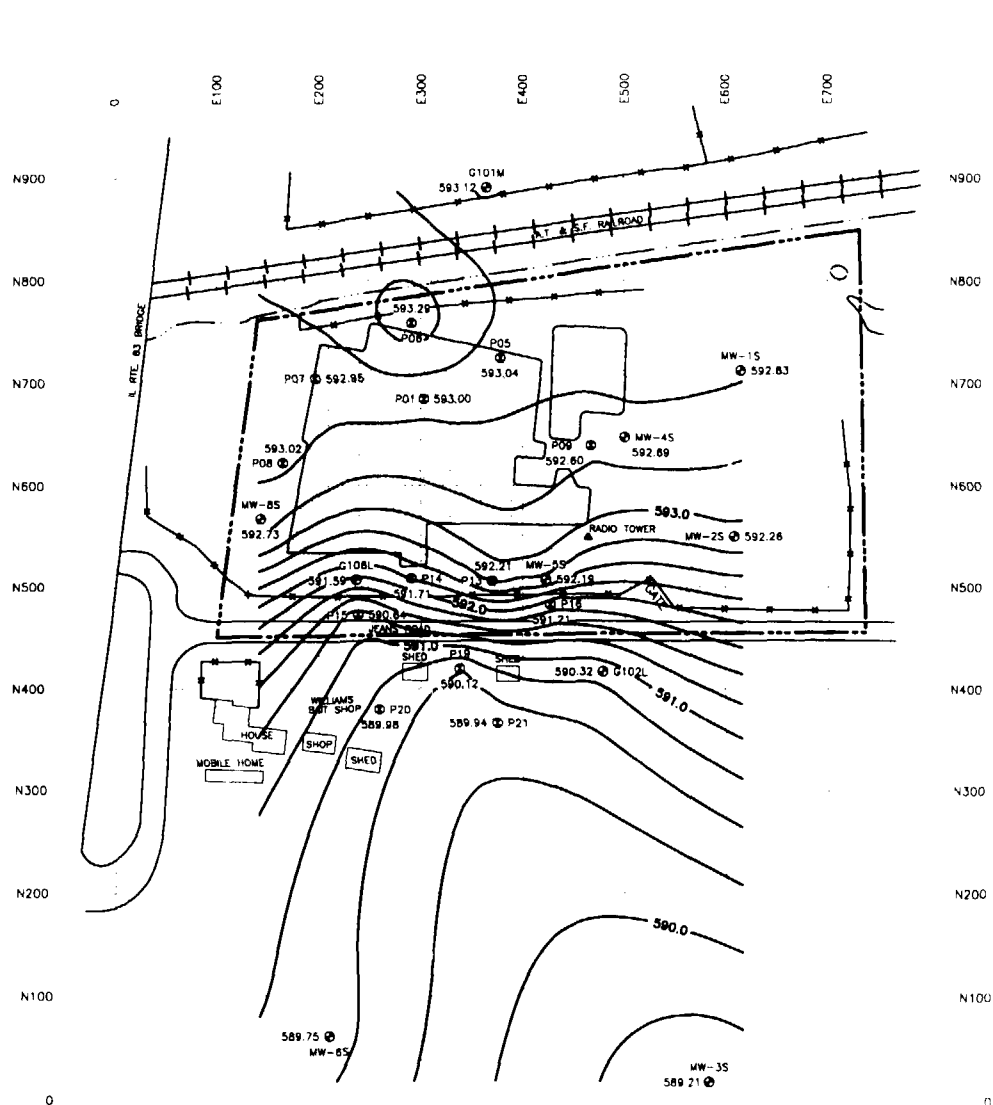
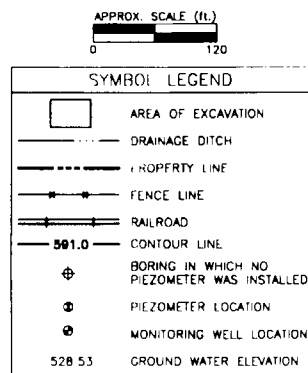


FIGURE F-1
PIEZOMETRIC SURFACE ELEVATION
SHALLOW WELLS/PIEZOMETERS
AUGUST 18, 1994
LENZ OIL SITE
LEMONT, ILLINOIS



NOTES:

THE EXCAVATION BOUNDARIES ARE BASED ON SKETCHES PROVIDED BY THE ILLINOIS ENVIRONMENTAL PROTECTION AGENCY FOR THE REMEDIAL INVESTIGATION REPORT PREPARED BY ERM-NORTH CENTRAL, INC. ACCORDING TO FIELD OBSERVATIONS. PIEZOMETERS P05 AND P07 ARE OUTSIDE THE AREA OF THE MAIN EXCAVATION, AND PIEZOMETER P11 IS INSIDE THE AREA OF THE MAIN EXCAVATION.

ALL ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL.

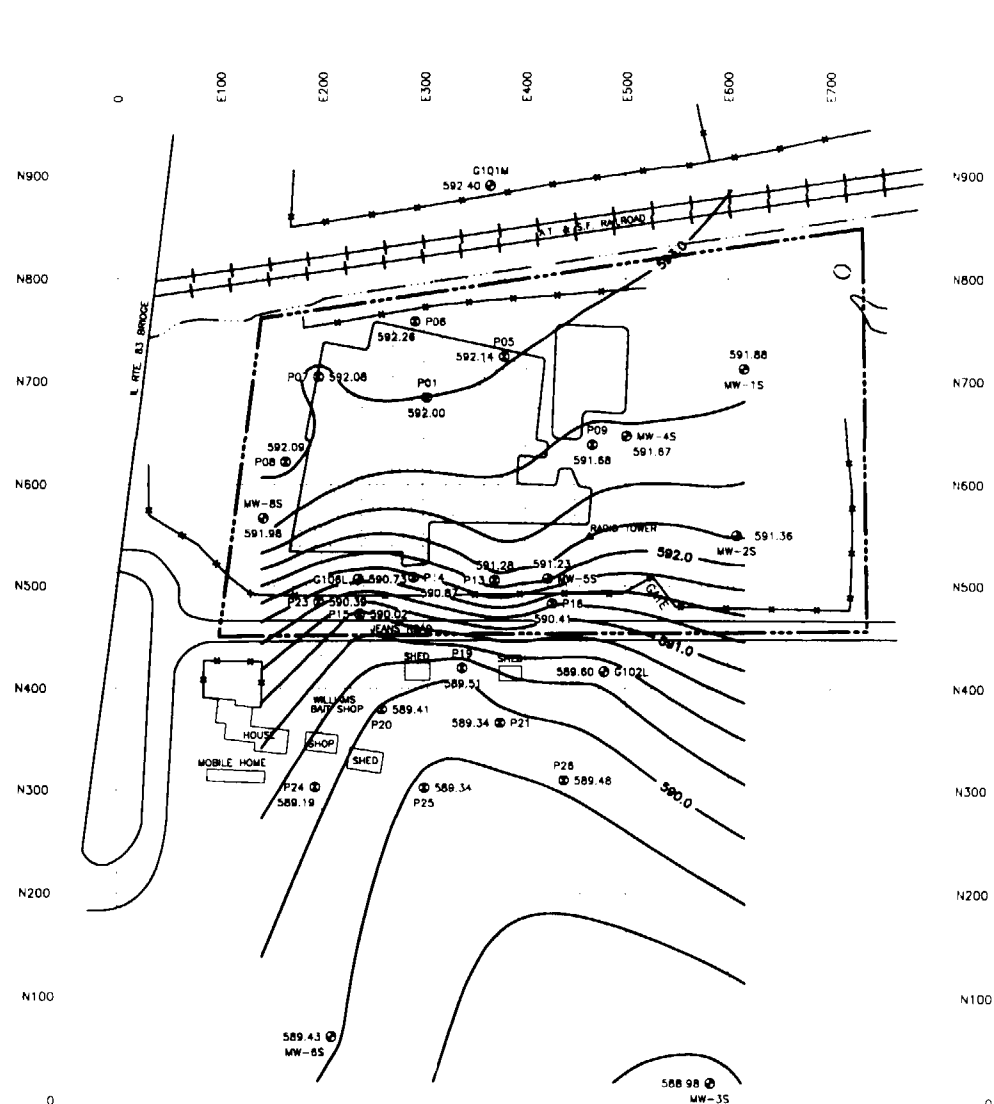
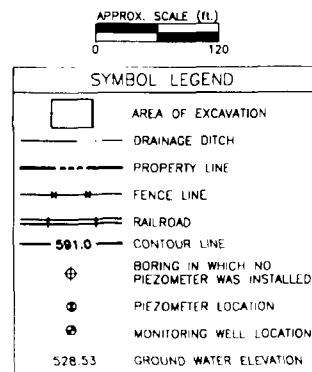


FIGURE F-3
PIEZOMETRIC SURFACE ELEVATION
SHALLOW WELLS/PIEZOMETERS
SEPTEMBER 2, 1994
LENZ OIL SITE
LEMONT, ILLINOIS



NOTES:

THE EXCAVATION BOUNDARIES ARE BASED ON SKETCHES PROVIDED BY THE ILLINOIS ENVIRONMENTAL PROTECTION AGENCY FOR THE REMEDIAL INVESTIGATION REPORT PREPARED BY ERM-NORTH CENTRAL, INC. ACCORDING TO FIELD OBSERVATIONS, PIEZOMETERS P05 AND P07 ARE OUTSIDE THE AREA OF THE MAIN EXCAVATION, AND PIEZOMETER P11 IS INSIDE THE AREA OF THE MAIN EXCAVATION. ALL ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL.

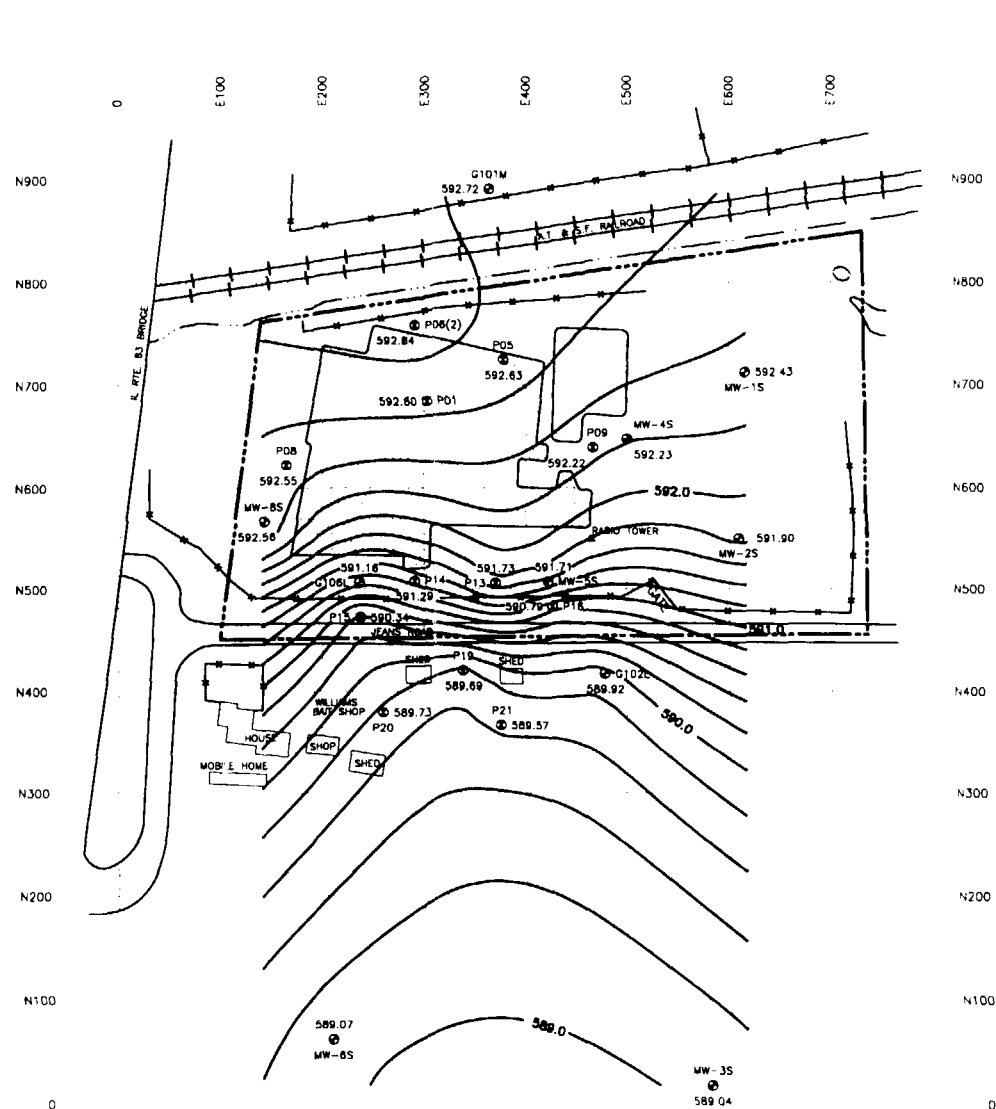


FIGURE F-4
PIEZOMETRIC SURFACE ELEVATION
SHALLOW WELLS/PIEZOMETERS
SEPTEMBER 9, 1994
LENZ OIL SITE
LEMONT, ILLINOIS

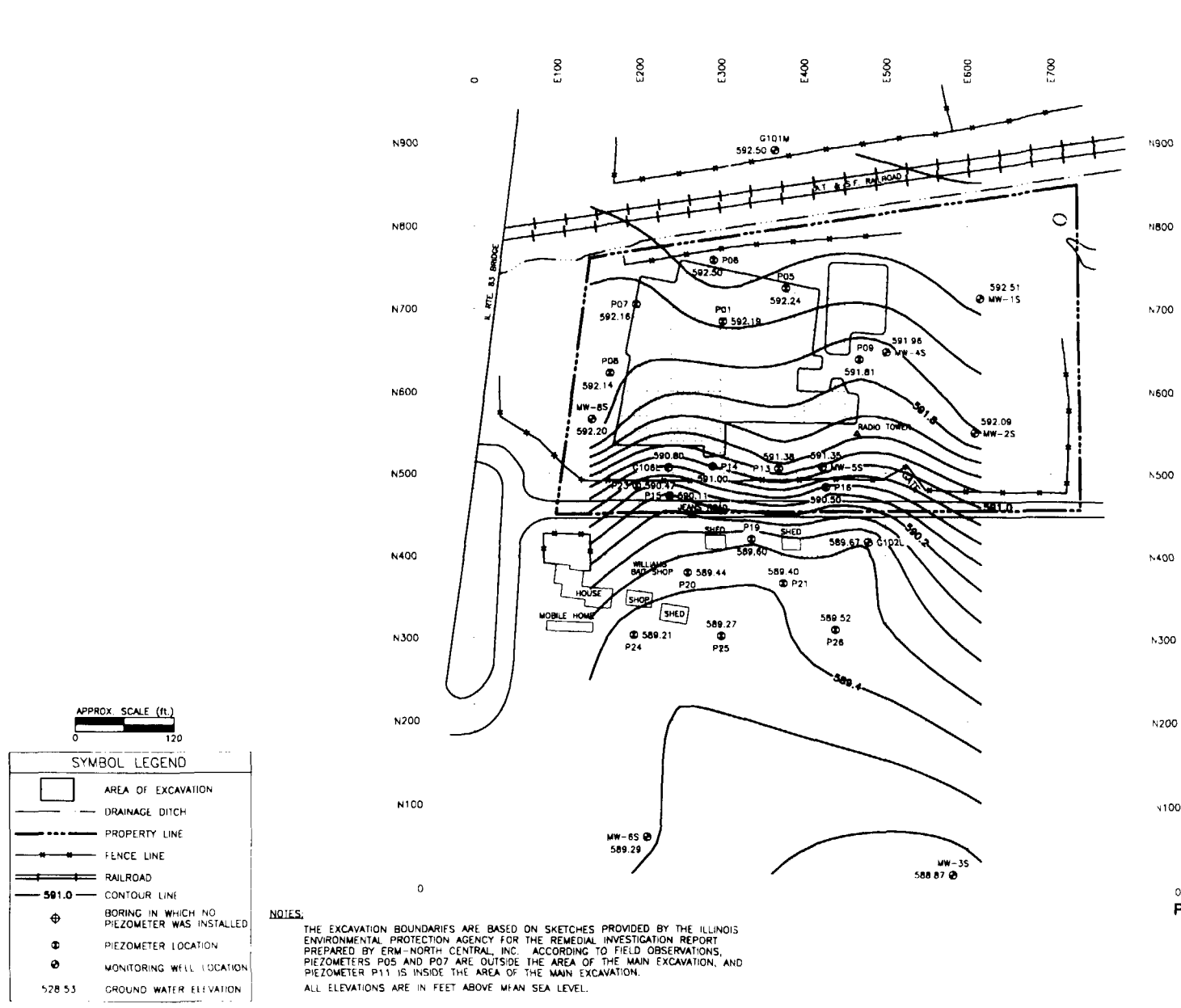


FIGURE F-5
PIEZOMETRIC SURFACE ELEVATION
SHALLOW WELLS/PIEZOMETERS
SEPTEMBER 16, 1994
LENZ OIL SITE
LEMONT, ILLINOIS

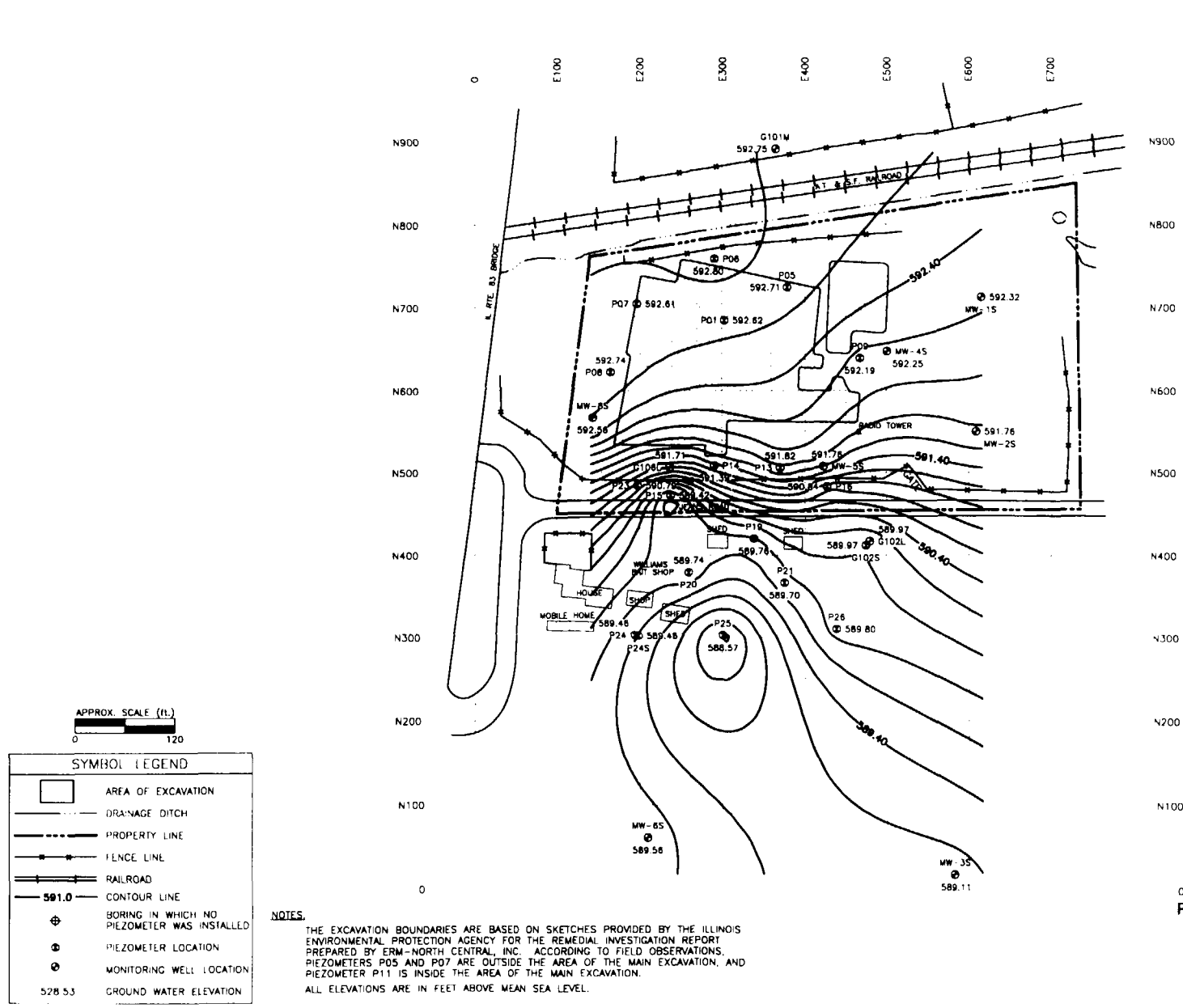
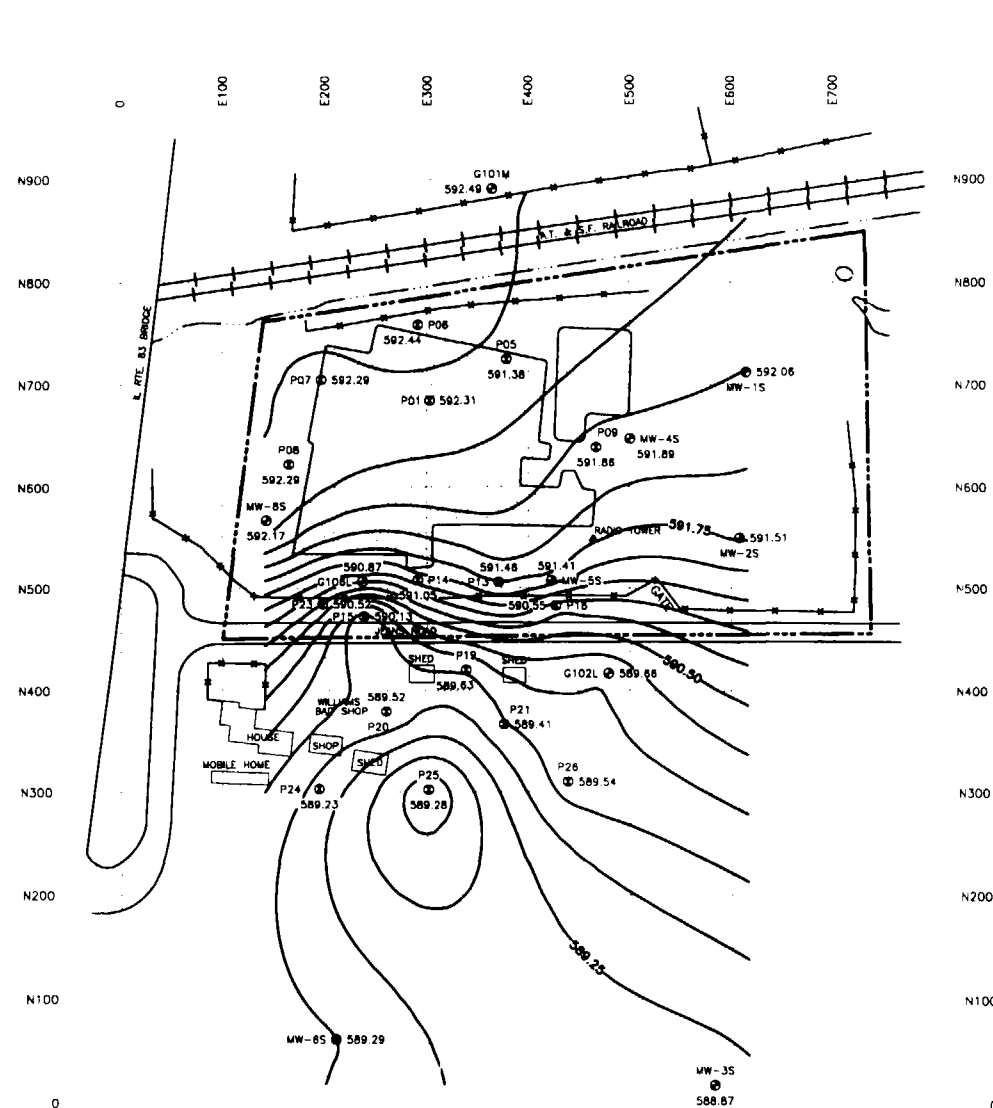


FIGURE F-7
PIEZOMETRIC SURFACE ELEVATION
SHALLOW WELLS/PIEZOMETERS
SEPTEMBER 30, 1994
LENZ OIL SITE
LEMONT, ILLINOIS

K:\CPFILES\ERMA\S&A\94017\07\ACAD\APPNDX\AP00794.DWG MAR 16, 1995 10:03 AM
 3/16/95 CMM-



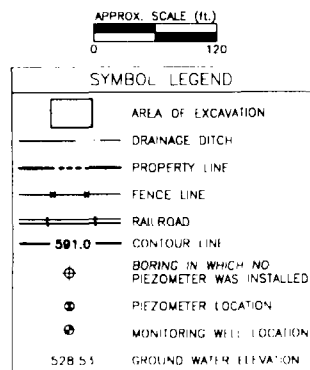
SYMBOL LEGEND	
[Solid line]	AREA OF EXCAVATION
[Dashed line]	DRAINAGE DITCH
[Dotted line]	PROPERTY LINE
[Line with cross-ticks]	FENCE LINE
[Line with cross-ticks]	RAILROAD
[Line with cross-ticks]	CONTOUR LINE
[Circle with cross]	BORING IN WHICH NO PIEZOMETER WAS INSTALLED
[Circle with dot]	PIEZOMETER LOCATION
[Circle with dot]	MONITORING WELL LOCATION
528.53	GROUND WATER ELEVATION

NOTES:

THE EXCAVATION BOUNDARIES ARE BASED ON SKETCHES PROVIDED BY THE ILLINOIS ENVIRONMENTAL PROTECTION AGENCY FOR THE REMEDIAL INVESTIGATION REPORT PREPARED BY ERM-NORTH CENTRAL, INC. ACCORDING TO FIELD OBSERVATIONS. PIEZOMETERS P05 AND P07 ARE OUTSIDE THE AREA OF THE MAIN EXCAVATION, AND PIEZOMETER P11 IS INSIDE THE AREA OF THE MAIN EXCAVATION. ALL ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL.

FIGURE F-8
PIEZOMETRIC SURFACE ELEVATION
SHALLOW WELLS/PIEZOMETERS
OCTOBER 7, 1994
LENZ OIL SITE
LEMONT, ILLINOIS





NOTES:

THE EXCAVATION BOUNDARIES ARE BASED ON SKETCHES PROVIDED BY THE ILLINOIS ENVIRONMENTAL PROTECTION AGENCY FOR THE REMEDIAL INVESTIGATION REPORT PREPARED BY LRM-NORTH CENTRAL, INC. ACCORDING TO FIELD OBSERVATIONS, PIEZOMETERS P05 AND P07 ARE OUTSIDE THE AREA OF THE MAIN EXCAVATION, AND PIEZOMETER P11 IS INSIDE THE AREA OF THE MAIN EXCAVATION. ALL ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL

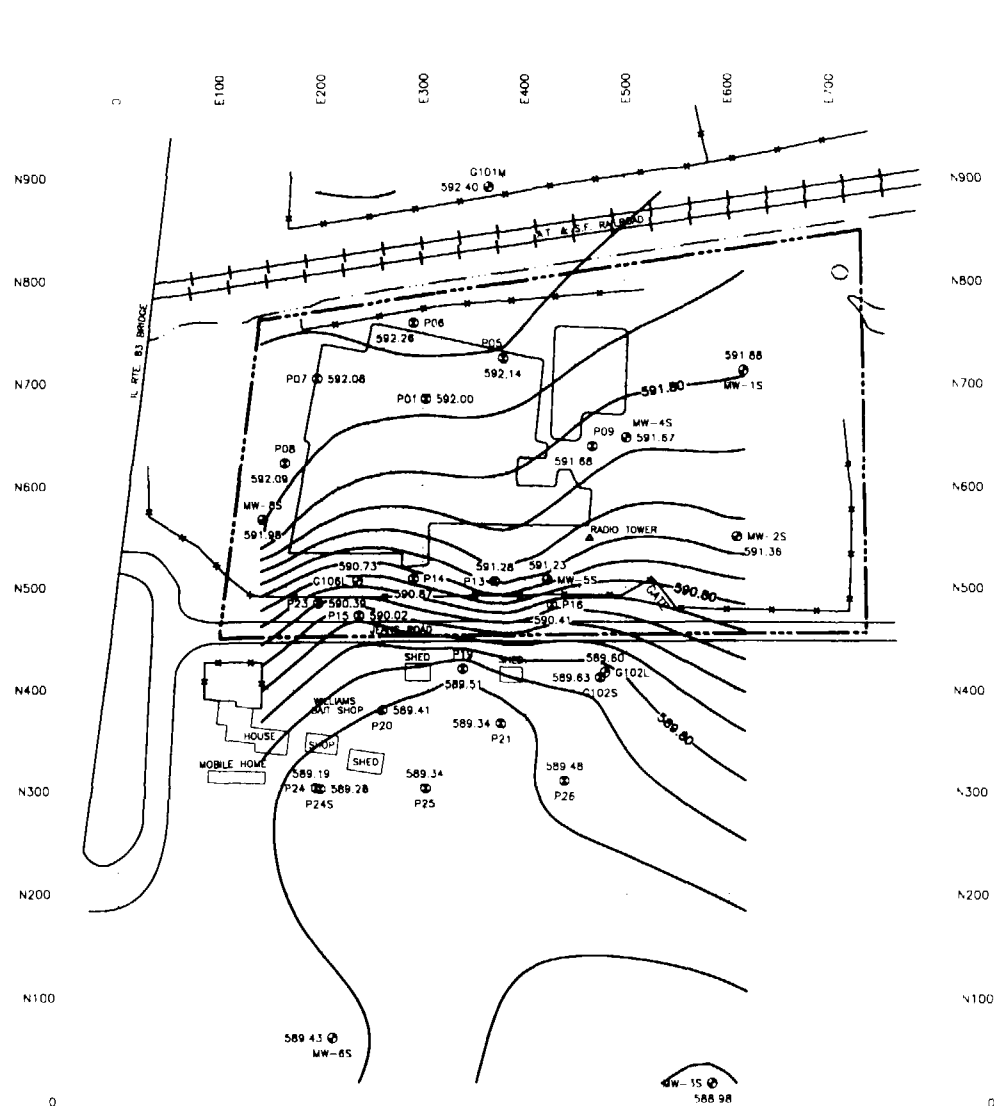


FIGURE F-9
PIEZOMETRIC SURFACE ELEVATION
SHALLOW WELLS/PIEZOMETERS
OCTOBER 25, 1994
LENZ OIL SITE
LEMONT, ILLINOIS

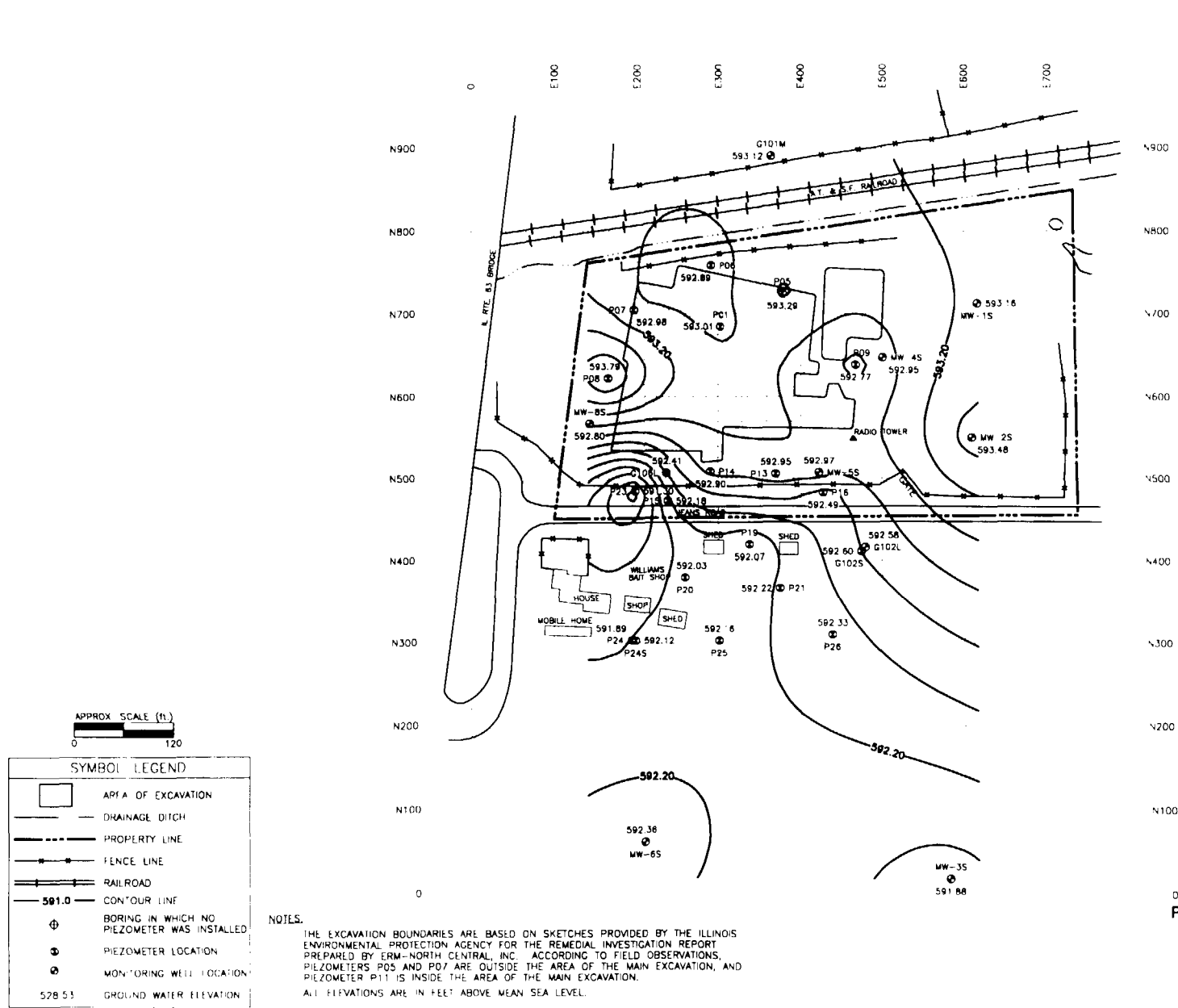


FIGURE F-10
PIEZOMETRIC SURFACE ELEVATION
SHALLOW WELLS/PIEZOMETERS
NOVEMBER 1, 1994
LENZ OIL SITE
LEMONT, ILLINOIS

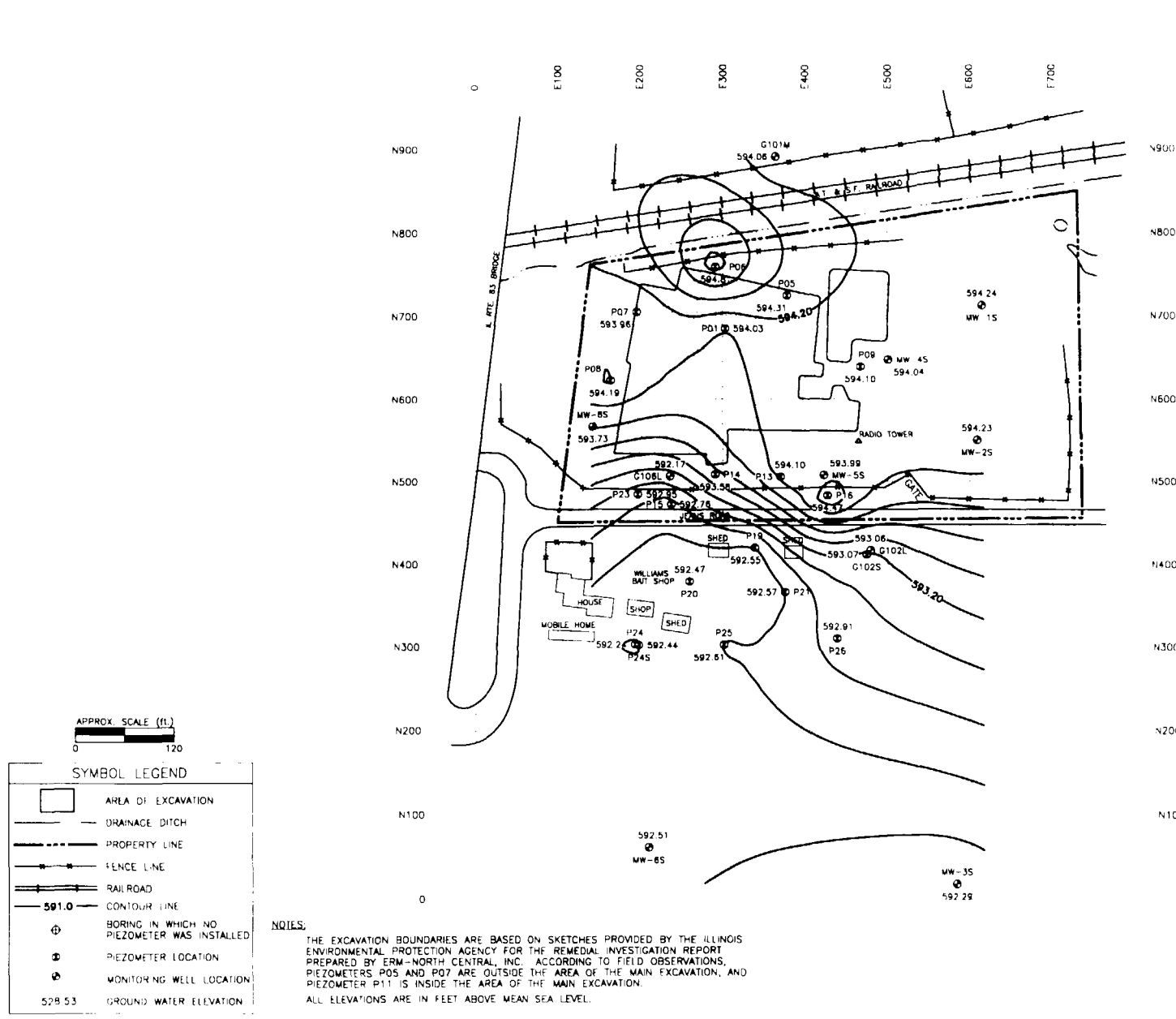


FIGURE F-11
PIEZOMETRIC SURFACE ELEVATION
SHALLOW WELLS/PIEZOMETERS
NOVEMBER 8, 1994
LENZ OIL SITE
LEMONT, ILLINOIS

APPENDIX G
VALIDATED DATA TABLES

SOIL

SECTION 2

ANALYTICAL RESULTS

A. ORGANICS

ERM-North Central, Inc.

ORGANIC DATA TABLE NOTES

- U - This compound should be considered "not-detected" since it was detected in a blank at a similar level.
- R - Unusable result; compound may or may not be present due to a quality control problem identified during the quality assurance review.
- J - Quantitation is approximate due to limitations identified during the quality assurance review.
- UJ - The compound was not detected, but the quantitation limit is probably higher due to a low bias identified during the quality assurance review.

VOLATILE ORGANIC ANALYSIS							
ERM-North Central, Inc. Sample Number		LOSP01E	LOSP06D	LOSP08D	LOSP08DFB	LOSP08DTB	LOSP13E
Laboratory Sample Number		C408047-02A	C408047-01A	C408071-03A	C408071-01A	C408071-02A	C408050-01A
Remarks					Field Blank	Trip Blank	
Units		µg/Kg	µg/Kg	µg/Kg	µg/L	µg/L	µg/Kg
VOLATILE COMPOUNDS	Quantitation Limit						
Chloromethane	10		UJ				
Bromomethane	10						
Vinyl Chloride	10						
Chloroethane	10	UJ					
Methylene Chloride	10			11 U	1 J		
Acetone	10	150 U	280	31 U			11 U
Carbon Disulfide	10						
1,1-Dichloroethene	10						
1,1-Dichloroethane	10						26
Total 1,2-Dichloroethene	10						170
Chloroform	10						
1,2-Dichloroethane	10						
2-Butanone	10	50	86				
1,1,1-Trichloroethane	10						
Carbon Tetrachloride	10						
Bromodichloromethane	10						
1,1,2,2-Tetrachloroethane	10						
1,2-Dichloropropane	10						
trans-1,3-Dichloropropene	10						
Trichloroethene	10						65
Dibromochloromethane	10						
1,1,2-Trichloroethane	10						
Benzene	10	33	16				14
cis-1,3Dichloropropene	10						
Bromoform	10						
2-Hexanone	10						
4-Methyl-2-Pentanone	10						

VOLATILE ORGANIC ANALYSIS							
ERM-North Central, Inc. Sample Number		LOSP01E	LOSP06D	LOSP08D	LOSP08DFB	LOSP08DTB	LOSP13E
Laboratory Sample Number		C408047-02A	C408047-01A	C408071-03A	C408071-01A	C408071-02A	C408050-01A
Remarks					Field Blank	Trip Blank	
Units		µg/Kg	µg/Kg	µg/Kg	µg/L	µg/L	µg/Kg
VOLATILE COMPOUNDS	Quantitation Limit						
Tetrachloroethene	10						1 J
Toluene	10	3 J	22	2 J			31
Chlorobenzene	10	6 J					
Ethylbenzene	10	350	85				1 J
Styrene	10						
Total Xylenes	10	720	570				7 J
Quantitation Limit Multiplier		1.7	1.5	1.1	1.0	1.0	1.1
Data Sample Collection		8/2/94	8/2/94	8/5/94	8/5/94	8/5/94	8/3/94
Date Sample Received by Laboratory		8/3/94	8/3/94	8/6/94	8/6/94	8/6/94	8/4/94
Date of Sample Analysis		8/12/94	8/10/94	8/10/94	8/15/94	8/15/94	8/10/94
Instrument Used for Analysis		GCMSE	GCMSE	GCMSE	GCMSE	GCMSE	GCMSE

EXTRACTABLE ORGANIC ANALYSIS							
ERM-North Central, Inc. Sample Number			LOSP01E	LOSP06D	LOSP08D	LOSP08DFB	LOSP13E
Laboratory Sample Number			C408047-02B	C408047-01B	C408071-03B	C408071-01D	C408050-01B
Remarks			Analyzed Twice			Field Blank	
Units			µg/Kg	µg/Kg	µg/Kg	µg/L	µg/Kg
SEMIVOLATILE COMPOUNDS	Quantitation Limit (Aq)	Quantitation Limit (Sol)					
Phenol	10	330					
bis(2-Chloroethyl)ether	10	330					
2-Chlorophenol	10	330					
1,3-Dichlorobenzene	10	330					
1,4-Dichlorobenzene	10	330					
1,2-Dichlorobenzene	10	330	710 J/800 J				27 J
2-Methylphenol	10	330					
2,2'-oxybis(1-Chloropropane)	10	330					
4-Methylphenol	10	330					
N-Nitroso-di-n-Propylamine	10	330			UJ		
Hexachloroethane	10	330					
Nitrobenzene	10	330					
Isophorone	10	330					
2-Nitrophenol	10	330					
bis(2-Chloroethoxy)methane	10	330					
2,4-Dimethylphenol	10	330					
1,2,4-Trichlorobenzene	10	330					
Naphthalene	10	330	1600 J/-				110 J
4-Chloroaniline	10	330					
Hexachlorobutadiene	10	330					
4-Chloro-3-Methylphenol	10	330					
2-Methylnaphthalene	10	330	39,000/35,000	790 J			180 J
Hexachlorocyclopentadiene	10	330	-/UJ	UJ		UJ	UJ
2,4,6-Trichlorophenol	10	330					
2,4,5-Trichlorophenol	10	330					
2-Chloronaphthalene	10	330					

EXTRACTABLE ORGANIC ANALYSIS						
ERM-North Central, Inc. Sample Number			LOSP01E	LOSP06D	LOSP08D	LOSP08DFB
Laboratory Sample Number			C408047-02B	C408047-01B	C408071-03B	C408071-01D
Remarks			Analyzed Twice			Field Blank
Units			µg/Kg	µg/Kg	µg/Kg	µg/L
SEMIVOLATILE COMPOUNDS	Quantitation Limit (Aq)	Quantitation Limit (Sol)				
2-Nitroaniline	10	330		UJ		UJ
Dimethylphthalate	10	330				
Acenaphthylene	10	330				
2,6-Dinitrotoluene	10	330				
3-Nitroaniline	10	330				
Acenaphthene	10	330	5700 U/5700 U		3700 U	
2,4-Dinitrophenol	10	330			R	
4-Nitrophenol	10	330	-/UJ	UJ		UJ
Dibenzofuran	10	330				
2,4-Dinitrotoluene	10	330				
Diethylphthalate	10	330				
4-Chlorophenyl-phenylether	10	330				
Fluorene	10	330	5700 U/5700 U		3700 U	
4-Nitroaniline	10	330	UJ/-			
4,6-Dinitro-2-Methylphenol	10	330	-/UJ			UJ
N-Nitrosodiphenylamine	10	330			1900 J	
4-Bromophenyl-phenylether	10	330	-/UJ			UJ
Hexachlorobenzene	10	330	-/UJ			UJ
Pentachlorophenol	10	330	-/UJ		R	UJ
Phenanthrene	10	330	5300 J/4900 J	2400 U	3700 U	370 U
Anthracene	10	330				
Carbazole	10	330				
Di-n-Butylphthalate	10	330		2400 U	3700 U	370 U
Fluoranthene	10	330				
Pyrene	10	330			3700 U	
Butylbenzylphthalate	10	330				(

EXTRACTABLE ORGANIC ANALYSIS						
ERM-North Central, Inc. Sample Number			LOSP01E	LOSP06D	LOSP08D	LOSP08DFB
Laboratory Sample Number			C408047-02B	C408047-01B	C408071-03B	C408071-01D
Remarks			Analyzed Twice			Field Blank
Units			$\mu\text{g/Kg}$	$\mu\text{g/Kg}$	$\mu\text{g/Kg}$	$\mu\text{g/L}$
SEMIVOLATILE COMPOUNDS	Quantitation Limit (Aq)	Quantitation Limit (Sol)				
3,3'-Dichlorobenzidine	10	330				
Benzo(a)anthracene	10	330				
bis(2-Ethylhexyl)phthalate	10	330		UJ	3700 U	3 J
Chrysene	10	330				
Di-n-Octylphthalate	10	330				
Benzo(b)fluoranthene	10	330				
Benzo(k)fluoranthene	10	330				
Benzo(a)pyrene	10	330				
Indeno(1,2,3-cd)pyrene	10	330				
Dibenz(a,h)anthracene	10	330				
Benzo(g,h,i)perylene	10	330				
Quantitation Limit Multiplier			17.3	7.27	11.2	1.00
Data Sample Collection			8/2/94	8/2/94	8/5/94	8/5/94
Date Sample Received by Laboratory			8/3/94	8/3/94	8/6/94	8/6/94
Date of Sample Analysis			8/18 & 8/19/94	8/15/94	8/18/94	8/19/94
Instrument Used for Analysis			GCMSL	GCMSL	GCMSM	GCMSL

TENTATIVELY IDENTIFIED COMPOUNDS					
ERM-North Central, Inc. Sample Number	LOSP01E C408047-02B	LOSP06D C408047-01B	LOSP08D C408071-03B	LOSP08DFB C408071-01D	LOSP13E C408050-01B
Laboratory Sample Number					
Remarks	Analyzed Twice			Field Blank	
Units	$\mu\text{g/Kg}$	$\mu\text{g/Kg}$	$\mu\text{g/Kg}$	$\mu\text{g/L}$	$\mu\text{g/Kg}$
COMPOUNDS					
SEMIVOLATILE COMPONENTS					
Trimethyl Benzene Isomer	8300 J/-				402 (2) J
1-Methyl Naphthalene	18,000 J/19,000 J				130 J
Dimethyl Naphthalene Isomer	41,000 (2) J/47,000 (2) J		3000 J		130 J
Unknown Hydrocarbon	125,500 (12) J/84,800 (10) J	65,860 (18) J	30,630 (10) J		1858 (13) J
Unknown	20,900 (2) J/41,300 (3) J	3000 (2) J			
Methyl Phenanthrene Isomer	-/4300 J		1500 J		
Dimethyl Phenanthrene Isomer	-/4900 J				
Ethyl Dimethyl Azulene			1100 J		
Dimethyl Biphenyl Isomer			2200 J		
Trimethyl Naphthalene Isomer			10,500 (3) J		
Hexanedioic Acid, Ester Derivative				8 J	
Blank Contamination				13 J	548 (3) R

EXTRACTABLE ORGANIC ANALYSIS						
ERM-North Central, Inc. Sample Number			LOSP06D	LOSP08D	LOSP08DFB	LOSP13E
Laboratory Sample Number			C408047-01B	C408071-03B	C408071-01F	C408050-01B
Remarks					Field Blank	
Units			µg/Kg	µg/Kg	µg/L	µg/Kg
PESTICIDES/PCBs	Quantitation Limit (Aq)	Quantitation Limit (Sol)				
alpha-BHC	0.05	1.7		UJ		
beta-BHC	0.05	1.7		UJ		
delta-BHC	0.05	1.7		UJ		
gamma-BHC (Lindane)	0.05	1.7		UJ		
Heptachlor	0.05	1.7		UJ		
Aldrin	0.05	1.7		UJ		
Heptachlor Epoxide	0.05	1.7		UJ		
Endosulfan I	0.05	1.7		UJ		
Dieldrin	0.10	3.3		UJ		
4,4'-DDE	0.10	3.3		UJ		
Endrin	0.10	3.3		UJ		
Endosulfan II	0.10	3.3		UJ		
4,4'-DDD	0.10	3.3		UJ		
Endosulfan Sulfate	0.10	3.3		UJ		
4,4'-DDT	0.10	3.3		UJ		
Methoxychlor	0.50	17		UJ		
Endrin Ketone	0.10	3.3		UJ		
Endrin Aldehyde	0.10	3.3		UJ		
alpha-Chlordane	0.05	1.7		UJ		
gamma-Chlordane	0.05	1.7		UJ		
Toxaphene	5.00	170		UJ		

EXTRACTABLE ORGANIC ANALYSIS						
ERM-North Central, Inc. Sample Number			LOSP06D	LOSP08D	LOSP08DFB	LOSP13E
Laboratory Sample Number			C408047-01B	C408071-03B	C408071-01F	C408050-01B
Remarks					Field Blank	
Units			$\mu\text{g/Kg}$	$\mu\text{g/Kg}$	$\mu\text{g/L}$	$\mu\text{g/Kg}$
PESTICIDES/PCBs	Quantitation Limit (Aq)	Quantitation Limit (Sol)				
Aroclor-1016	1.0	33		UJ		
Aroclor-1221	2.0	67		UJ		
Aroclor-1232	1.0	33		UJ		
Aroclor-1242	1.0	33	9800	UJ		
Aroclor-1248	1.0	33		90 J		610
Aroclor-1254	1.0	33	6900	59 J		600
Aroclor-1260	1.0	33		44 J		470
Quantitation Limit Multiplier			29.4	1.12	1.00	1.12
Data Sample Collection			8/2/94	8/5/94	8/5/94	8/3/94
Date Sample Received by Laboratory			8/3/94	8/6/94	8/6/94	8/4/94
Date of Sample Analysis			8/13/94	8/17/94	8/12/94	8/13/94

B. METALS, CYANIDE, AND HEXAVALENT CHROMIUM

ERM-North Central, Inc.

INORGANIC DATA TABLE NOTES

- U - This analyte should be considered "not-detected" since it was detected in a blank at a similar concentration level.
- R - Unusable result; analyte may or may not be present due to a quality control problem identified during the quality assurance review.
- J - Quantitation is approximate due to limitations identified during the quality assurance review.
- UJ - The analyte was not detected, but the quantitation limit is probably higher due to a low bias identified during the quality assurance review.

ANALYTICAL METHODS

- P - Inductively Coupled Plasma
- F - Graphite Furnace Atomic Absorption
- CV - Cold Vapor Atomic Absorption
- AS - Autoanalyzer - Spectrophotometry

INORGANIC ANALYSIS								
ERM-North Central, Inc. Sample Number				LOSP08D	LOSP06D	LOSP01ES	LOSP13E	LOSP08DFB
Laboratory Sample Number C408-				07103B	04701B	04702B	05001B	07101H
Remarks								Field Blank
Percent Solids				90.30 %	68.40 %	58.40 %	90.40 %	-
Units				mg/Kg	mg/Kg	mg/Kg	mg/Kg	µg/L
INORGANIC ELEMENTS		Detection Limit (Aq)	Detection Limit (Sol)					
Aluminum	P	100	20.0	1030 J	16,600 J	20,200 J	2770 J	
Antimony	P	50.0	10.0	UJ	UJ	UJ	UJ	
Arsenic	F	2.0	0.4	8.0 J	12.1 J	16.4 J	2.6 J	
Barium	P	100	20.0		106	145		
Beryllium	P	2.0	0.40		1.6 J	1.6 J		
Cadmium	P	4.0	0.80					
Calcium	P	1000	200	157,000	7780	8160	154,000	
Chromium	P	7.0	1.4	4.3 J	23.6	30.2	7.4	
Cobalt	P	10.0	2.0		8.7	14.8	3.9	
Copper	P	10.0	2.0	3.2	17.3	48.3	8.8	
Iron	P	50.0	10.0	14,100	49,500	29,700	6280	
Lead	F	2.0	0.4	2.1 J	79.3 J	32.4 J	3.1 J	
Magnesium	P	1000	200	95,300	5190	5520	90,600	
Manganese	P	5.0	1.0	342 J	152 J	322 J	266 J	
Mercury	CV	0.2	0.10	R	R	R	R	0.47
Nickel	P	20.0	4.0		19.5 J	39.4 J	6.5 J	
Potassium	P	2000	400	479	2040	3060	970	
Selenium	F	2.0	0.40		1.0	4.5		
Silver	P	5.0	1.0		2.0			
Sodium	P	2000	400		749	722		
Thallium	F	3.0	0.60	UJ	UJ	UJ	UJ	UJ
Vanadium	P	10.0	2.0		43.0	41.7	5.6	
Zinc	P	10.0	2.0	9.7 U	118	117	12.2 U	
Cyanide	AS	5.0	0.50	UJ	UJ	UJ	UJ	

LIGHT NONAQUEOUS PHASE LIQUID

SECTION 2

ANALYTICAL RESULTS

VOLATILE ORGANIC ANALYSIS							
ERM-NC, Inc. Sample Number		LONP19	LONP20	LONP20D	LONP21	LOSP29E	LOSP29EDL
Laboratory Sample Number		C410237-01A	C410237-02A	C410237-04A	C410237-03A	C410261-01B	C410261-01B
Remarks				Field Duplicate of LONP20			Dilution (LOSP29E)
Units		µg/L	µg/L	µg/L	µg/L	µg/Kg	µg/Kg
VOLATILE COMPOUNDS	Quantitation Limit						
Chloromethane	10	UJ	UJ	UJ	UJ		
Bromomethane	10						
Vinyl Chloride	10						
Chloroethane	10						
Methylene Chloride	10	UJ	UJ	UJ	UJ		10 U
Acetone	10	UJ	UJ	UJ	86000 J	32 J	UJ
Carbon Disulfide	10	UJ	UJ	UJ	UJ		
1,1-Dichloroethene	10				780 J		
1,1-Dichloroethane	10	UJ	UJ	UJ	3600 J	24	21 J
Total 1,2-Dichloroethene	10	460000 J	140000 J	140000 J	39000	140	130
Chloroform	10	UJ	UJ	UJ	UJ		
1,2-Dichloroethane	10					UJ	UJ
2-Butanone	10	UJ	UJ	UJ	UJ	UJ	UJ
1,1,1-Trichloroethane	10	290000 J	340000 J	370000 J	28000	17	22 J
Carbon Tetrachloride	10						
Bromodichloromethane	10						
1,1,2,2-Tetrachloroethane	10						
1,2-Dichloropropane	10						
trans-1,3-Dichloropropene	10						
Trichloroethene	10		83000 J	86000 J			
Dibromochloromethane	10						
1,1,2-Trichloroethane	10						
Benzene	10	330000 J	220000 J	240000 J	5200	93 J	87 J
cis-1,3-Dichloropropene	10						
Bromoform	10						

VOLATILE ORGANIC ANALYSIS							
ERM-NC, Inc. Sample Number		LONP19	LONP20	LONP20D	LONP21	LOSP29E	LOSP29EDL
Laboratory Sample Number		C410237-01A	C410237-02A	C410237-04A	C410237-03A	C410261-01B	C410261-01B
Remarks				Field Duplicate of LONP20			Dilution (LOSP29E)
Units		µg/L	µg/L	µg/L	µg/L	µg/Kg	µg/Kg
VOLATILE COMPOUNDS	Quantitation Limit						
2-Hexanone	10						
4-Methyl-2-Pentanone	10						
Tetrachloroethene	10		58000 J	65000 J	840 J		
Toluene	10	4400000	2900000	3100000	49000	690 J	710 J
Chlorobenzene	10						
Ethylbenzene	10	2000000	1200000	1300000	43000	130	160
Styrene	10						
Total Xylenes	10	8500000	5600000	6200000	230000	550 J	740
Quantitation Limit Multiplier		50,000	50,000	50,000	500	1.1	5.5
Date of Sample Collection		10/13/94	10/13/94	10/13/94	10/13/94	10/14/94	10/14/94
Date Sample Received by Laboratory		10/18/94	10/18/94	10/18/94	10/18/94	10/15/94	10/15/94
Date of Sample Analysis		10/24/94	10/24/94	10/24/94	10/24/94	10/21/94	10/21/94
Instrument Used for Analysis		GCMSK	GCMSK	GCMSK	GCMSK	GCMSK	GCMSK

EXTRACTABLE ORGANIC ANALYSIS							
Sample Number		LONP19	LONP20	LONP20D	LONP20S	LONP21	LOSP29E
Laboratory Sample Number		C410237-01H	C410237-02I	C410237-04D	C410237-05D	C410237-03I	C410261-01A
Remarks				Field Duplicate of LONP20	Field Triplicate of LONP20		Medium Level Soil
Units		µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg
SEMIVOLATILE COMPOUNDS		Quantitation Limit (Sol)					
Phenol	330						
bis(2-Chloroethyl)ether	330						
2-Chlorophenol	330						
1,3-Dichlorobenzene	330						
1,4-Dichlorobenzene	330						
1,2-Dichlorobenzene	330						
2-Methylphenol	330						
2,2'-oxybis(1-Chloropropane)	330						
4-Methylphenol	330						
N-Nitroso-di-n-Propylamine	330						
Hexachloroethane	330						
Nitrobenzene	330						
Isophorone	330						
2-Nitrophenol	330						
2,4-Dimethylphenol	330						
bis(2-Chloroethoxy)methane	330						
2,4-Dichlorophenol	330						
1,2,4-Trichlorobenzene	330						
Naphthalene	330	800000	860000 J	780000 J	1000000 J	700000 J	
4-Chloroaniline	330	UJ	UJ	UJ	UJ	UJ	
Hexachlorobutadiene	330						
4-Chloro-3-Methylphenol	330						
2-Methylnaphthalene	330	2400000	2700000	2800000	3300000	2900000	1600 J
Hexachlorocyclopentadiene	330						UJ
2,4,6-Trichlorophenol	330						

EXTRACTABLE ORGANIC ANALYSIS							
Sample Number		LONP19	LONP20	LONP20D	LONP20S	LONP21	LOSP29E
Laboratory Sample Number		C410237-01I	C410237-02I	C410237-04D	C410237-05D	C410237-03I	C410261-01A
Remarks				Field Duplicate of LONP20	Field Triplicate of LONP20		Medium Level Soil
Units		µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg
SEMIVOLATILE COMPOUNDS	Quantitation Limit (Sol)						
2,4,5-Trichlorophenol	800						
2-Chloronaphthalene	330						
2-Nitroaniline	800						UJ
Dimethylphthalate	330						
Acenaphthylene	330						
2,6-Dinitrotoluene	330						
3-Nitroaniline	800	UJ	UJ	UJ	UJ	UJ	97 J
Acenaphthene	330		170000 J	170000 J	160000 J	230000 J	
2,4-Dinitrophenol	800						UJ
4-Nitrophenol	800						UJ
Dibenzofuran	330						
2,4-Dinitrotoluene	330						
Diethylphthalate	330						
4-Chlorophenyl-phenylether	330						
Fluorene	330	190000 J	210000 J	260000 J	270000 J	220000 J	200 J
4-Nitroaniline	800	UJ	UJ	UJ	UJ	UJ	
4,6-Dinitro-2-Methylphenol	800						
N-Nitrosodiphenylamine	330						
4-Bromophenyl-phenylether	330						
Hexachlorobenzene	330						
Pentachlorophenol	800	R	R	R	R	R	
Phenanthrene	330	470000 J	550000 J	570000 J	640000 J	640000 J	480 J
Anthracene	330						
Carbazole	330						
Di-n-Butylphthalate	330						240 J

EXTRACTABLE ORGANIC ANALYSIS							
Sample Number		LONP19	LONP20	LONP20D	LONP20S	LONP21	LOSP29E
Laboratory Sample Number		C410237-01I	C410237-02I	C410237-04D	C410237-05D	C410237-03I	C410261-01A
Remarks				Field Duplicate of LONP20	Field Triplicate of LONP20		Medium Level Soil
Units		µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg
SEMIVOLATILE COMPOUNDS	Quantitation Limit (Sol)						
Fluoranthene	330						
Pyrene	330						
Butylbenzylphthalate	330						
3,3'-Dichlorobenzidine	330						
Benzo(a)anthracene	330						
bis(2-Ethylhexyl)phthalate	330	660000	490000 J	500000 J	640000 J	230000 J	3200
Chrysene	330						
Di-n-Octylphthalate	330						
Benzo(b)fluoranthene	330						
Benzo(k)fluoranthene	330						
Benzo(a)pyrene	330						
Indeno(1,2,3-cd)pyrene	330						
Dibenz(a,h)anthracene	330						
Benzo(g,h,i)perylene	330						
Quantitation Limit Multiplier		1515	3030	6061	6061	6061	5.45
Date of Sample Collection		10/13/94	10/13/94	10/13/94	10/13/94	10/13/94	10/14/94
Date Sample Received by Laboratory		10/18/94	10/18/94	10/18/94	10/18/94	10/18/94	10/15/94
Date of Sample Extraction		10/20/94	10/20/94	10/20/94	10/20/94	10/20/94	10/20/94
Date of Sample Analysis		11/1/94	11/1/94	11/1/94	11/1/94	11/1/94	10/31/94
Instrument Used for Analysis		GCMSL	GCMSL	GCMSL	GCMSL	GCMSL	GCMSJ

PURGEABLE ORGANIC ANALYSIS						
ERM-NC Sample Number	LOSP29E	LOSP29EDL	LONP19	LONP20	LONP20D	LONP21
Laboratory Sample Number	C410261-01B	C410261-01B	C410237-01A	C410237-02A	C410237-04A	C410237-03A
Remarks	5.0 g Sample	Dilution Factor 5	Dilution Factor 50,000	Dilution Factor 50,000	Dilution Factor 50,000	Dilution Factor 500
Units	µg/Kg	µg/Kg	µg/L	µg/L	µg/L	µg/L
TENTATIVELY IDENTIFIED COMPOUNDS (No. of Peaks)						
VOLATILE COMPONENTS						
Unknown	20 (2) J		640000 J	1470000 (2) J	860000 J	8800 (2) J
Propylbenzene	17 J					50000 J
Ethylmethyl Benzene Isomer	82 (2) J	134 (2) J	1500000 J	1100000 J	1670000 (2) J	195000 (2) J
Trimethyl Benzene Isomer	104 (2) J	140 J	3730000 (2) J	2820000 (2) J	2730000 (2) J	425000 (2) J
2,4-Dimethylhexane			1900000 J	2060000 (2) J	920000 J	
3-Ethyl-4-Methylhexane			980000 J			
4-Methyloctane			920000 J			
Unknown Hydrocarbon			2230000 (2) J	1100000 J	1240000 (2) J	92000 (2) J
Decane			1500000 J	1100000 J		
3-Ethyl-2-Methylheptane				550000 J		
2,3,4-Trimethylhexane					680000 J	
Methyl Octane Isomer					530000 J	
3-Ethyl-2-Methylheptane						32000 J
Bromocycloheptane						32000 J
Cyclohexanemethanol						140000 J

EXTRACTABLE ORGANIC ANALYSIS						
ERM-NC Sample Number	LONP19	LONP20	LONP20D	LONP20S	LONP21	LOSP29E
Laboratory Sample Number	C410237-01I	C410237-02I	C410237-04D	C410237-05D	C410237-03I	C410261-01A
Remarks	Dilution Factor 50	Dilution Factor 100	Dilution Factor 200	Dilution Factor 200	Dilution Factor 200	Dilution Factor 5.0
Units	$\mu\text{g/Kg}$	$\mu\text{g/Kg}$	$\mu\text{g/Kg}$	$\mu\text{g/Kg}$	$\mu\text{g/Kg}$	$\mu\text{g/Kg}$
TENTATIVELY IDENTIFIED COMPOUNDS (No. of Peaks)						
SEMIVOLATILE COMPONENTS						
Cyclohexene (Solvent Preservative)	1300000 R	3200000 R	9400000 R	7400000 R	9300000 R	
Pyridine	ND	ND	ND	ND	ND	
Unknown	3350000 (2) J	4900000 J				25000 J
Unknown Hydrocarbon	35900000 (14) J	2146050000 (15) J	65000000 (15) J	67200000 (15) J	71000000 (16) J	12800 (11) J
Dimethyl Naphthalene Isomer	3200000 (2) J	3400000 (2) J	4400000 (2) J	4700000 (2) J	5200000 (2) J	1900 J
Trimethyl Naphthalene Isomer			1700000 J	1400000 J		910 J
4-Hydroxy-4-Methyl-2-Pentanone (Aldol Reaction Product)						15000 R
Diethyl Benzene Isomer						2100 J
Unknown Alkane						59300 (3) J
1-Methyl-Naphthalene						4700 J

ND - Not detected in oil samples. See quality assurance review.

ERMPEST.XLS

EXTRACTABLE ORGANIC ANALYSIS						
ERM-NC, Inc. Sample Number		LONP19	LONP20	LONP20D	LONP21	LOSP29E
Laboratory Sample Number		C140237-01E	C140237-02E	C140237-04D	C140237-03E	C410261-01AR
Remarks				Duplicate of LONP20		
Units		$\mu\text{g/Kg}$	$\mu\text{g/Kg}$	$\mu\text{g/Kg}$	$\mu\text{g/Kg}$	$\mu\text{g/Kg}$
PESTICIDES/PCBs	Quantitation Limit					
alpha-BHC	1.7	UJ	UJ	UJ	UJ	UJ
beta-BHC	1.7	UJ	UJ	UJ	UJ	UJ
delta-BHC	1.7	UJ	UJ	UJ	UJ	UJ
gamma-BHC (Lindane)	1.7	UJ	UJ	UJ	UJ	UJ
Heptachlor	1.7	UJ	UJ	UJ	UJ	UJ
Aldrin	1.7	UJ	UJ	UJ	UJ	UJ
Heptachlor Epoxide	1.7	UJ	UJ	UJ	UJ	UJ
Endosulfan I	1.7	UJ	UJ	UJ	UJ	UJ
Dieldrin	3.3	UJ	UJ	UJ	UJ	UJ
4,4'-DDE	3.3	UJ	UJ	UJ	UJ	UJ
Endrin	3.3	UJ	UJ	UJ	UJ	UJ
Endosulfan II	3.3	UJ	UJ	UJ	UJ	UJ
4,4'-DDD	3.3	UJ	UJ	UJ	UJ	UJ
Endosulfan Sulfate	3.3	UJ	UJ	UJ	UJ	UJ
4,4'-DDT	3.3	UJ	UJ	UJ	UJ	UJ
Methoxychlor	17	UJ	UJ	UJ	UJ	UJ
Endrin Ketone	3.3	UJ	UJ	UJ	UJ	UJ
Endrin Aldehyde	3.3	UJ	UJ	UJ	UJ	UJ
alpha-Chlordane	1.7	UJ	UJ	UJ	UJ	UJ
gamma-Chlordane	1.7	UJ	UJ	UJ	UJ	UJ
Toxaphene	170	UJ	UJ	UJ	UJ	UJ

ERMPEST.XLS

EXTRACTABLE ORGANIC ANALYSIS						
ERM-NC, Inc. Sample Number		LONP19	LONP20	LONP20D	LONP21	LOSP29E
Laboratory Sample Number		C140237-01E	C140237-02E	C140237-04D	C140237-03E	C410261-01AR
Remarks				Duplicate of LONP20		
Units		µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg
PESTICIDES/PCBs	Quantitation Limit					
Aroclor-1016	33	UJ	UJ	UJ	UJ	UJ
Aroclor-1221	67	UJ	UJ	UJ	UJ	UJ
Aroclor-1232	33	UJ	UJ	UJ	UJ	UJ
Aroclor-1242	33	210,000 J	200,000 J	170,000 J	65,000 J	49 J
Aroclor-1248	33	UJ	UJ	UJ	UJ	UJ
Aroclor-1254	33	UJ	UJ	UJ	UJ	UJ
Aroclor-1260	33	38,000 J	38,000 J	30,000 J	42,000 J	UJ
Quantitation Limit Multiplier		600	600	600	600	1.1
Date of Sample Collection		10/13/94	10/13/94	10/13/94	10/13/94	10/14/94
Date Sample Received by Laboratory		10/19/94	10/19/94	10/19/94	10/19/94	10/15/94
Date of Sample Extraction		10/31/94	10/31/94	10/31/94	10/31/94	10/31/94
Date of Sample Analysis		11/9/94	11/9/94	11/9/94	11/9/94	11/9/94

B. METALS AND CYANIDE

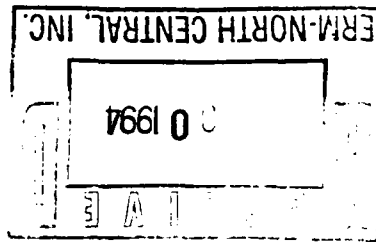
INORGANIC ANALYSIS							
Sample Number			LONP19	LONP20	LONP21	LONP20D	LOSP29E
Laboratory Sample Number			C41023701G	C41023702G	C41023703G	C41023704D	C41026101A
Remarks						Duplicate of LONP20	
Percent Solids			100 %	100 %	100 %	100 %	91.40 %
Units			mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
INORGANIC ELEMENTS		Detection Limit (mg/Kg)					
Aluminum	P	20	22.3	20.9			1780
Antimony	F	10	UJ	UJ	UJ	UJ	UJ
Arsenic	F	0.2	5.0	3.5	2.7	2.4	2.5
Barium	P	20	168	165	121	154	
Beryllium	P	0.4					
Cadmium	P	0.8					
Calcium	P	200	322	314	275	300	166,000
Chromium	P	1.0	6.5	6.3	6.1	6.2	5.9 J
Cobalt	P	2.0					
Copper	P	2.0	2.0		3.9		4.9
Iron	P	10.0	54.4	44.7	71.7	44.7	5010
Lead	F	0.2	146	150	81.2	148	4.3
Magnesium	P	200					86,300
Manganese	P	1.0	1.5	1.4	1.1	1.2	197
Mercury	CV	0.15					UJ
Nickel	P	4.0	UJ	UJ	UJ	UJ	UJ
Potassium	P	400					702
Selenium	F	0.2	UJ	UJ	0.46 J	UJ	UJ
Silver	P	1.0	UJ	UJ	UJ	UJ	UJ
Sodium	P	400					
Thallium	F	0.2					UJ
Vanadium	P	2.0	3.2	2.6	2.6	3.7	4.3
Zinc	P	2.0	4.7	4.2	4.1	4.9	11.8
Cyanide	A	2.0	UJ	UJ	UJ	UJ	UJ

APPENDIX H

**LABORATORY NARRATIVE FOR THE
LIGHT NONAQUEOUS PHASE LIQUID SAMPLES**

Quanterra Incorporated
1721 South Grand Avenue
Santa Ana, California 92705

714 258-8610 Telephone
714 258-0921 Fax



ERM North Central
540 Lake Cook Rd., Suite 300
Deerfield, IL 60015

December 28, 1994

Attn: Elsie Milano

AMENDED CASE NARRATIVE

This is the Case Narrative for the following:

Client Project ID:	Lenz Oil
Work Order No:	C4-10-237, C4-10-261
CSQB/SDG:	LZ002

Introduction

The Client Specific QC Batch (CSQB)# LZ002 of Lenz Oil samples was received at the Santa Ana Laboratory over two (2) days (October 15 and 19). The batch consists of six (6) samples, one (1) soil sample and five (5) oil samples. Please see the attached CSQB form.

Sample Receipt Information

The shipments were received intact, with the noted exceptions.

Samples LONP19, LONP20, LONP21, LONP20D and LONP20S were received at 7.3 degrees celcius, which is outside the acceptable temperature range of 4 +/- 2 degrees. Per the client (Sue Staley), the laboratory was instructed to proceed with analysis.

Samples LONP19, LONP20, LONP21, LONP20D and LONP20S were received over two days. The samples did not arrive in one shipment, as expected.

Samples LONP19, LONP20, LONP21, LONP20D and LONP20S were originally scheduled for both TCLP analyses and CLP analyses. As part of the TCLP procedure, the samples were filtered to determine percent solids. As the percent solids were negligible, no extraction was required of any of these samples. This information was relayed to the client, and the TCLP analyses were subsequently cancelled per the client, as the CLP analyses would yield the same results as the non-extracted TCLP results.

Method References

The samples were analyzed for CLP volatile organics using combined gas chromatography-mass spectrometry according to EPA Contract Laboratory Program (CLP) Statement of Work (SOW) OLM01 protocol.

The samples were analyzed for CLP semivolatile organics using combined gas chromatography-mass spectrometry according to EPA CLP SOW OLM01 protocol.

The samples were extracted and analyzed for CLP organochlorine pesticides and PCBs using gas chromatography according to EPA CLP SOW OLM01 protocol.

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The samples were analyzed for Target Analyte List (TAL) metals and cyanide according to the EPA CLP statement of work (SOW) ILM03.0.

The samples were analyzed for Total Chromatographable Organics (TCO) by SOP LM-RMA-4039. Slight modifications to this SOP were made based on standard availability and matrix considerations.

The samples were analyzed for herbicides according to SW846 method 8150 at the Quanterra, Garden Grove facility. Their report is attached.

The oil samples were analyzed for specific gravity per ASTM D1480 at the Quanterra, Garden Grove facility. The results were reported from the Santa Ana facility.

The samples were analyzed for viscosity according to ASTM D445-88 by Hauser. Their report is attached.

Quality Control

Volatile Organics:

Matrix spike/matrix spike duplicate (MS/MSD) analyses were performed on sample LONP20S. Matrix spike/matrix spike duplicate analyses were also performed on sample LOSEP29E, although not required by the client. The data has been included in the data package.

The matrix of sample LONP19, LONP20, LONP21, LONP20D and LONP20S is oil. The form ls for these samples indicate the matrix is water. The choice of matrix is limited on the form ls to either soil or water, so the matrix of water was used to ensure the result units would be consistent with the sample prep technique (dilute and shoot). The QC limits used for these samples is soil, however, which are more appropriate to an oil matrix.

The recovery of bromofluorobenzene in sample LONP21 was quantitated using a secondary ion (mass 174) due to matrix interference.

The recoveries of benzene and toluene in the MSD sample and the RPD between the MS and MSD recoveries for toluene in the MS/MSD samples was outside control limits. Sample inhomogeneity may have contributed to these problems. No corrective action was taken.

Samples LONP19, LONP20, and LONP20D required a 1:50,000 dilution and sample LONP21 required a 1:500 dilution due to high concentrations of non-target and target compounds.

Sample LOSEP29E was analyzed using both 1 and 5 gram aliquots due to a high level of toluene found in the sample. Results from both analyses have been reported. The 1 gram analysis is identified as LOSEP29EDL.

Semivolatiles:

Matrix spike/matrix spike duplicate analyses were performed on sample LONP20S.

All oil samples were extracted as medium level soils due to matrix. Further dilutions were required on these extracts, which caused most surrogates and QC compounds to be diluted below detection levels.

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Sample LOSP29E required a 1:5 dilution due to hydrocarbon interference.

The oil samples were originally analyzed for CLP analytes; no search for pyridine was performed. A TCLP standard containing pyridine was subsequently analyzed along with the oil samples at the same dilutions required for the CLP analyses. The retention time of pyridine in the standard was 4.333 minutes
QUANTERRA WO #: C4-10-237, C4-10-261

at scan 213. A search for pyridine in the samples at that retention time yielded no hits. The pyridine results are reported on the TIC forms with results of 0 ug/kg.

Pesticides:

Matrix spike/matrix spike duplicate analyses were performed on sample LONP20S. Matrix spike/matrix spike duplicate analyses were also performed on sample LOSP29E, although not requested by the client. The data has been included in the data package.

Sample LOSP29E was re-extracted three (3) days outside of holding time and samples LONP19, LONP20, LONP20D, LONP20S, LONP20SMS, LONP20MSD and LONP21 were re-extracted four (4) days outside of holding times due to methoxychlor contamination in the original extracts. The original analyses are not reportable, so the reextract results are considered original results and are not identified as reextracts in the data pack.

The percent recoveries of decachlorobiphenyl and tetrachloro-m-xylene were outside control limits on both the DB608 and DB1701 columns for samples PBLK03 and LCS-103194X. Upon investigation, it was found that the above samples were inadvertently spiked twice with the spike and surrogate solutions. The surrogate and spike recoveries, when halved, were within control limits. No further corrective action was taken. The associated field sample is LOSP29E.

The percent recovery of tetrachloro-m-xylene was outside control limits on the DB608 column for samples LONP19, LONP20, LONP20D, LONP20SMS and LONP21. No corrective action was taken, as the recoveries are advisory and were likely to have been affected by matrix.

The matrix spike recoveries in sample LONP20MS and LONP20MSD were diluted out due to a 20 fold dilution of the samples.

TCO:

Matrix spike/matrix spike duplicate analyses were performed on sample LONP20S. Matrix spike/matrix spike duplicate analyses were also performed on sample LOSP29E although not required by the client. The data has been included in the data package.

Fuel oil #4, fuel oil #6, and leaf hydrocarbons standards were unavailable at time of analysis and were not targeted in the TCO analysis. The lab was, therefore, unable to distinguish between fuel oil #2 and fuel #4 due to the unavailability of the later standard.

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The resolution of C17/pristane and C18/phytane was not determined due to the unavailability of standards at time of analysis.

Benzo(A)pyrene was used as a surrogate instead of OTP because it is less prone to matrix interferences.

As matrix spike spike control limits for TCO in oils were not established, the matrix spike limits for TCO in soils are referenced.

The matrix spike recoveries for LOSP29EMS and LONP20D were outside control limits. These events appeared to be due to matrix as all surrogate and LCS recoveries were within control limits.

The chromatographic fingerprint of the samples did not match that of the reference standards and suggested the possible presence of multiple fuel mixtures. The patterns eluted beyond C32 but were quantitated from C8-C32.

Metals: Matrix spike/duplicate analyses were performed on sample LONP20S.

LONP19, LONP20, LONP20D and LONP21 are oils. These sample were treated like soils for preparation and results were calculated based on 100% solids.

The matrix spike recoveries for lead, selenium and silver were -117.6%, 62.1% and 68.9%, respectively, which were outside the EPA QC requirements of 75-125%. Because the lead result for the spike sample was greater than four time that of the spike added, the associated sample results for lead were not flagged. All associated sample results for selenium and silver, however, were flagged with an "N."

The matrix spike recovery for cyanide was 57%, which was outside the EPA QC requirements of 75-125%. A post digestion spike was performed and the result was 107%. All associated sample results were flagged with an "N."

Specific Gravity: LCS and LCS duplicate analyses were performed as QC.

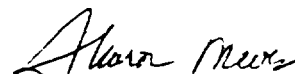
Quality control met acceptance criteria.

Viscosity: The samples were analyzed by Hauser laboratories. Their report is attached.

Certification

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or his designee, as verified by the following signature:

Reviewed and Approved


Sharon Meves
Project Manager